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THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS
and

IDENTIFICATION SECTION

AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

TOMATO LATE BLIGHT:
ITS WORLD DISTRIBUTION AND PRESENT STATUS

Supplement 231

April 30, 1955



The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops Research Branch

Plant Industry Station, Beltsville, Maryland

TOMATO LATE BLIGHT:
ITS WORLD DISTRIBUTION AND PRESENT STATUS

Paul R. Miller and Muriel J. O'Brien

Plant Disease Reporter
Supplement 231

April 30, 1955

INTRODUCTION

In 1946 *Phytophthora infestans*, without warning, caused an estimated \$40,000,000 loss in tomatoes in the United States. In the elements of suddenness and extent of damage, but not, of course, in disastrous consequences, this outbreak was a repetition, after a century almost to the year, of the potato late blight epidemic in 1845 that caused the tragic Irish famine, when millions of acres of potatoes were destroyed in Europe, and in Ireland alone a quarter million people were victims of starvation. Potato late blight again became a major influence in human affairs in the closing year of World War I, when the 1918 epidemic was among the forces that led to Germany's surrender.

The records indicate that these two severe epidemics on potato in Europe resulted from extended periods of very favorable weather coupled with lack of control.

We do not have a satisfactory explanation to account for the outbreak of late blight on tomatoes in the United States in 1946. Records for the eastern half of the country show that the weather was favorable for blight during most of the growing season, and it is true that a high percentage of the southern-grown tomato plants used throughout the area of commercial tomato production were infected. However, in other years when conditions were apparently just as favorable the disease was reported as of minor importance. A study of the various races of *Phytophthora infestans* that were present during 1946 and subsequent years does not supply any illuminating evidence. In the light of the extensive and intensive observations since 1946 none of these factors alone or in combination seems adequate to explain this third major episode in the history of late blight.

The late blight organism possesses demonstrated flexibility, and further surprises in its development are to be expected. Lack of knowledge concerning the way in which the various forms arise and increase, the place and time of their origin, and the manner of their spread by either natural or other means is a serious matter in view of the known history and recognized potentialities of the disease.

The world-wide survey reported herein is an attempt to obtain clues that might help in answering at least some of these questions. It was restricted to tomato late blight primarily to avoid confusion and bulk. Except for certain details the information for the most part is probably applicable to potato late blight also.

To make this study as current as possible we sent a letter-questionnaire to about one hundred plant pathologists, requesting information on occurrence, distribution, spread, control, economic importance, and strains of the fungus. We appreciate very much the almost universal response to our request. We acknowledge our indebtedness to the individual workers who furnished information for their respective areas, and thank them for their cooperation.

The list of contributors can be found on pages 80-86.

EUROPE

First Report

AUSTRIA:

No report of any outbreak of Phytophthora infestans on tomatoes in Austria.

BALEARIC ISLANDS: See under Spain.

BELGIUM:

Reported in the literature (1921) as occurring on tomato after a particularly wet period. [Cf. Marchal, É. & Ém., etc.; see Bibliography.]

CANARY ISLANDS: See under Spain.

CYPRUS:

No first date of appearance recorded.

DENMARK:

Tomato late blight was first reported in Denmark in 1888.

ENGLAND:

Published references to the occurrence of potato blight on tomato can be traced back in our early gardening literature to 1878.

ESTONIA [Estonian S.S.R.]:

Reported in the literature (1926). [Cf. Lepik, E., etc.; Käsebier, A., etc.; see Bibliography.]

FINLAND:

First year of definite record was 1931.

FRANCE:

Known to be present.

GERMANY:

Stem and fruit rot of tomato, due to Phytophthora infestans, was reported for the first time in 1907 in the official records of the German Plant Protection Service on the appearance of diseases and parasites.

GREECE:

Reported in the literature (1936) as occurring on tomato in Greece. [Cf. Sarejanni, J. A., etc.; see Bibliography.]

HUNGARY:

An epidemic reported in the literature (1914) as occurring in 1913 which brought about great damage on foliage and fruit. [Cf. von Ruhmwerth, R. Rapaics, etc.; see Bibliography.]
Again reported in 1938. [Cf. Moesz, G., etc.; see Bibliography.]

IRELAND: See under Northern Ireland or Republic of Ireland.

ITALY:

Apparently tomato late blight appeared in the same year as it appeared on potato, namely in 1843 in Lombardy; in the year 1844 in Piedmont, and in the year 1845 it was common in all peninsular Italy.

No authentic early record is available for Sardinia until the first decade of this century. Apparently, however, the disease has been established since the second half of the past century.

NETHERLANDS:

Exact date not known; long known to occur on outdoor tomatoes.

NORTHERN IRELAND:

Late blight of tomato was first reported in Ireland by Professor Johnson of Dublin in 1901. His record appears in the Irish Naturalist, vol. 10: 253. 1901.

NORWAY:

Recorded in 1898.

POLAND:

Reported in literature (1941) as occurring in the districts of Warsaw and Lublin in 1940, leaves and fruits being heavily attacked. [Cf. Minkiewicz, St., etc.; see Bibliography.]

REPUBLIC OF IRELAND:

Phytophthora infestans first recorded attacking tomatoes on September 23, 1914.

ROMANIA:

Reported in the literature (1943) as occurring almost throughout the whole country (in years 1940-41). A particularly heavy attack occurred in the Departments of Botosani, Donohoi, Sibiu, Muscel, Târnava Mică, Alba, etc. [Cf. Săvulescu, T., et al., etc.; see Bibliography.]

SARDINIA: See under Italy.

SCOTLAND:

Blight on tomatoes was recorded first in 1942 but almost certainly had occurred before this date since blight on potato crops has been recorded in Scotland since 1845.

SPAIN:

First reference of Phytophthora infestans on tomato and potato was made by Prof. Ascaratein in "Insectos y Criptogamas que invaden los cultivos en España." Madrid, 1893; no locality given.

It is known to occur in the Baleares Islands. In the Canary Islands it is recorded at Tenerife and Gran Canaria.

SWITZERLAND:

No indications of when tomato late blight was first found in eastern Switzerland.

U. S. S. R.

Reported in the literature (1906) as occurring on July 20, 1903 in a garden in Kursk. [Cf. Bondartseva, A. S., see Bibliography.]

Also reported in the literature (1926) as occurring in and near Leningrad, the tomato fruits being severely attacked and the foliage less severely. [Cf. Bondartseva-Monteverde, V. N., etc.; see Bibliography.]

YUGOSLAVIA:

No record of the first report of tomato blight in Yugoslavia; believe that this disease, however, has existed in Yugoslavia for a long time.

Distribution

BALEARIC ISLANDS: See under Spain.

CANARY ISLANDS: See under Spain.

CYPRUS:



Cyprus
(Chamberlin Trimetric
Proj. *118.4 miles to the inch)

Records have indicated its presence in the Paphos district, the Nicosia district, and in the Famagusta district.

* For all the individual country maps the scale indicated is before the uniform 25 percent reduction. See inside back cover for the world distribution map.

DENMARK:

Tomato late blight can be found in all parts of Denmark.



Denmark
(Chamberlin Trimetric Proj.
118.4 miles to the inch)

ENGLAND:



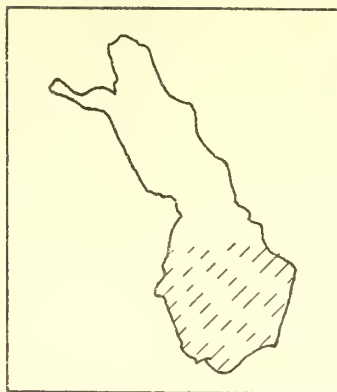
The disease is recorded from most parts of the country every year. As most of the outdoor crops are grown in the southern counties, it is usually only of economic importance there although it is occasionally serious in unheated houses in northern districts.

In Yorkshire and Lancashire the crop is not grown out of doors but is grown a great deal in unheated Dutch glass structures particularly in East Yorkshire. The large ventilators are left permanently open in the summer and spores of the blight fungus often get in and infect the leaves situated near the ventilator and many of the fruits.

England and Wales
(Chamberlin Trimetric Proj.
118.4 miles to the inch)

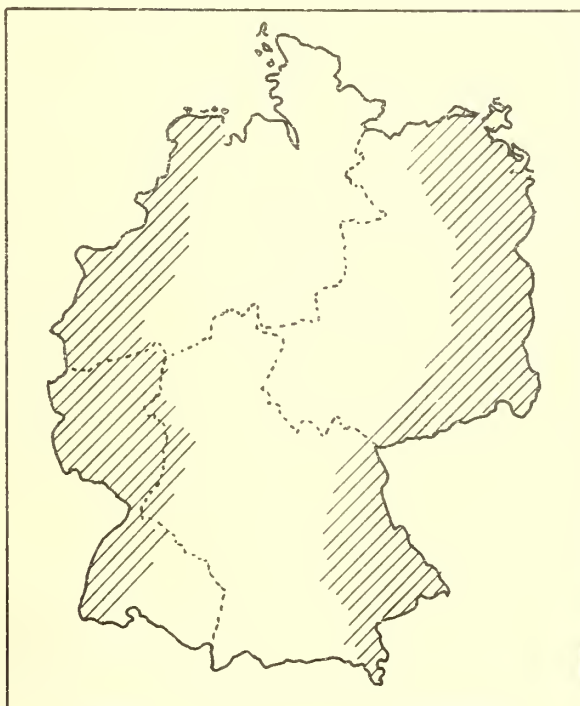
FINLAND:

According to a rough estimate, the northern limit of the occurrence of late blight on tomato might be the 64th latitude.



Finland
(Van der Grinten's Proj.
632 miles to the inch)

GERMANY:



Germany
(Chamberlin
Trimetric Proj.
118.4 miles
to the inch)

The disease is widespread both in West and East Germany, differing in intensity according to weather conditions and the control measures taken. In years of severe attack of *Phytophthora* on potato, as for example 1951 and 1954, tomatoes are also usually affected; however, more or less local loss is regularly reported in other years in nearly all parts of the country.

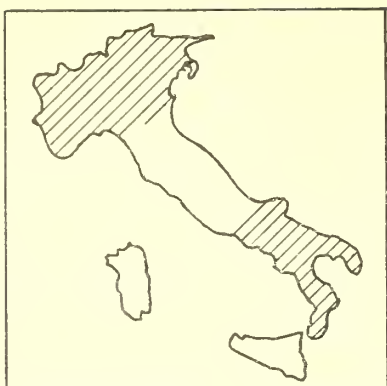
Since the fungus requires moisture and heat for its development, it is found especially in localities having a high degree of precipitation in summer and a high air-humidity. Such conditions prevail at least at times throughout Germany during the months from July to September, owing to frequent showers, and favor outbreaks of the disease.

GUERNSEY (Isle of):

Tomatoes grown almost wholly as a glasshouse crop.

IRELAND: See under Northern Ireland or Republic of Ireland.

ITALY:

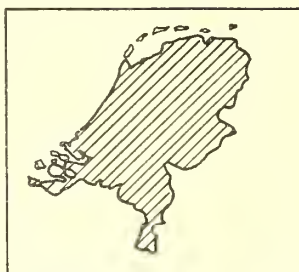


Italy
(Van der Grinten's Proj.
395 miles to the inch)

The distribution of tomato late blight is universal because of the moist spring and first half of summer in northern Italy and the rainy winter and first half of spring in the south of Italy.

The greatest bulk of production of tomatoes is in northern Italy, both for fresh fruits and tomato paste; second highest is the production in southern Italy, also for fresh fruits and for the peeled fruit industry. The small production of insular Italy is confined almost totally to Sicily. It is interesting for the production, under culture in the open air, and exportation of very early green fruits.

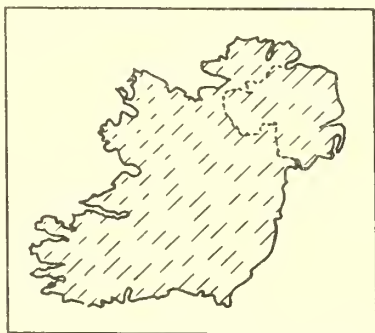
NETHERLANDS:



Netherlands
(Chamberlin Trimetric Proj.
118.4 miles to the inch)

Present over the country but exclusively or almost exclusively on outdoor tomatoes. Outdoor tomatoes are grown mostly in the western and southern part of our country. The area of outdoor tomatoes is small in comparison with that of the glasshouse tomatoes.

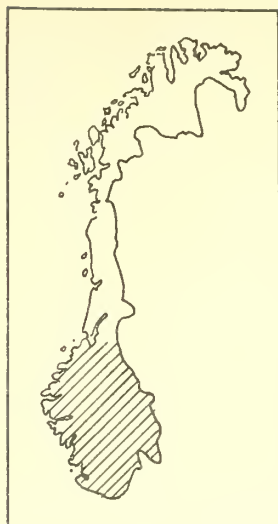
NORTHERN IRELAND:



Northern Ireland
and
Republic of Ireland
(Chamberlin Trimetric Proj.
118.4 miles to the inch)

Late blight of tomato is of common occurrence in Northern Ireland but it cannot be regarded as a major disease of this fruit. The climate is not suitable for growing outdoor tomatoes but if the crop is grown out of doors, late blight can be a serious problem. It is seldom if ever seen on tomato crops growing in heated glasshouses but it does occur now and again on the crop being grown in unheated glasshouses. In such cases it is commonly found attacking plants growing near a ventilator or which have very close access to the conditions obtaining outside the house. It has been seen, for instance attacking a truss of fruits which had grown through a ventilator and were exposed to the outside air.

NORWAY:



Southern Norway northwards to
Trøndelag (district around Trondheim).

Norway
(Van der Grinten's Proj.
632 miles to the inch)

REPUBLIC OF IRELAND:

Wherever tomatoes are grown outside in this country, Phytophthora infestans invariably appears on the plants during September and October. In bad seasons it may be present during the month of August. [See with Northern Ireland for map.]

SCOTLAND:



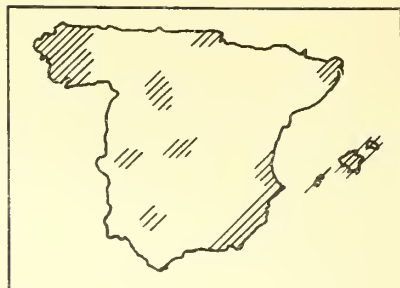
It has been reported from all areas
wherever tomatoes are grown commercially
in main drainage areas of Solway, Clyde,
Tweed, Forth, Tay, Dee and Moray.

Scotland
(Chamberlin Trimetric Proj.
118.4 miles to the inch)

SPAIN:



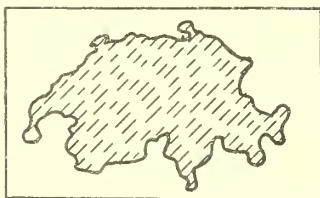
Canary Islands
(Chamberlin Trimetric Proj.
189.4 miles to the inch)



Spain
and
Balearic Islands
(Van der Grinten's Proj.
395 miles to the inch)

The provinces of Spain in which Phytophthora infestans attacks tomatoes are: Alicante, Almería, Cáceres, Coruña, Lugo, Gerona, Guipúzcoa, Murcia, Orense, Sevilla, Toledo, Valencia, Valladolid, Baleares, Gran Canaria, and Tenerife.

SWITZERLAND:

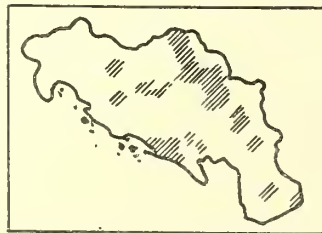


Switzerland
(Chamberlin Trimetric
118.4 miles to the inch)

No visible differences in regional
distribution; appears here and there.

YUGOSLAVIA:

Tomato late blight is distributed in
the following republics: Macedonia,
Serbia, Montenegro, Bosnia-Herzegovina,
and Croatia.



Yugoslavia
(Van der Grinten's Proj.
395 miles to the inch)

CANARY ISLANDS:

In the Canary Islands infections are favored by windless nights with dew; attack is principally on the under parts of the plant stalk and following a wilt on the upper ones. Plants are close and the under parts are less exposed to the winds and more exposed to infection. Also, tomato fruits are sometimes attacked.

CYPRUS:

Cyprus has no information available regarding the method of infection.

DENMARK:

We are growing a lot of potatoes in most parts of Denmark, and it seems that blight is spread to the tomatoes from the potatoes. No part of Denmark is further than 100 kilometers from the sea, and the weather in August and September often is very humid. In most years we find blight on tomatoes all over the country.

There seem to be no special potential danger spots.

ENGLAND:

Spread is by air-borne spores and is favoured by the damp, warm "blight" weather we experience here in late summer about one year in three.

FINLAND:

It is thought that potato fields are the most important source of late blight infection on tomato and the environmental conditions which favor potato late blight infection increase the spread of Phytophthora onto tomato.

GERMANY:

Information in regard to the spread of the disease is not available in any detail. Dispersal of the conidia by wind and water is an important factor.

The regions in which the disease is particularly serious have not yet been determined.

IRELAND: See under Northern Ireland or Republic of Ireland.

ITALY:

Wind and rain are the principal means of spread. The general weather of the season is greatly modified by the local topography, with local endemic "spots" as source of inoculum. One must remember the very uneven geographical situation of Italy, including the fact that the great culture of tomato in north Italy is localized near the pedemountain border of the Appennines.

JERSEY (Isle of):

Tomatoes are interplanted with early potatoes and experimental evidence suggests that whilst the potatoes are very susceptible to infection by conidia from the tomatoes, the reverse is not true, as tomatoes are little affected by blighted potatoes growing nearby.

MALTA:

Usually after rains which are rather infrequent at the time of maturation of tomato crops.

NETHERLANDS:

Wind dissemination. Source of infection presumably always potatoes. Potatoes are grown intensively all over the country. Every year to a greater or lesser extent they are attacked by Phytophthora.

NORTHERN IRELAND:

Owing to the endemic nature of potato late blight in Northern Ireland, the same might be said to hold for the organism attacking tomato; presumed that the pattern of spread would closely follow that for late blight of potato.

NORWAY:

Late blight is always spread as conidia from potato fields and is nearly always found on tomato fruits only (not often on the leaves), mostly on tomatoes in the open and in non-heated houses. Tomatoes far from potato fields are usually not attacked.

REPUBLIC OF IRELAND:

The principal method of spread here appears to be the wind. The potential danger spots are neighbouring potato crops.

SCOTLAND:

In general, the disease is of very minor importance in even the more concentrated tomato-growing area in the Clyde Valley. The principal factor here is that, in general, potato crops -- except early varieties which ripen-off before blight becomes active -- are not grown near to commercial tomato glasshouses.

SWEDEN:

Most outbreaks occur on tomatoes grown outdoors, and the outbreaks are more common and also more severe in years when the potato blight causes the most damage.

Outdoor tomato growing is mostly non-commercial; the commercial growing being done under glass. The climatic conditions are very often not favourable for outdoor growing, especially in the northern half of the country.

SWITZERLAND:

Occurrence seems to be conditioned by climatic factors. In wet seasons the disease is rather frequent, while in dry summers it is of no practical importance.

YUGOSLAVIA:

Spread mostly by wind, especially where there is moisture in abundance and where tomato plants are not tied.

Damage

DENMARK:

Most of our tomatoes are grown in greenhouses and there we have full control over blight. We grow tomatoes in open land in all parts of Denmark but on a very small scale. It is, therefore, impossible to estimate the damage. In very humid and warm years (August-September) up to 90 percent of the crop can be damaged if we do not spray.

ENGLAND:

No reliable figures are available for losses caused; in "blight" years, however, rotting of the fruit, particularly in unsprayed outdoor crops, is often very considerable.

The damage in Yorkshire and Lancashire is not as a rule very great but in one season out of three it may spoil 1 to 5 percent of the fruits picked during late August and September.

FINLAND:

According to investigations on potato late blight in Finland, losses due to this disease are most severe in spots of low altitude and on sea shores where the air humidity is high. Losses in potatoes are more prevalent on clay soils.

GERMANY:

Figures on the extent of damage caused by the disease, particularly the quantity or value of losses, are not at hand. It has not infrequently been estimated, however, that up to 80 percent of the crop of Freiland tomatoes has been destroyed by Phytophthora.

IRELAND: See under Northern Ireland or Republic of Ireland.

ITALY:

It is almost impossible to calculate the amount of damage caused by tomato late blight be-

cause this pathogen is associated usually with other tomato diseases. Very frequently two or more pathogens are found in the same field if not on the same plant.

A rough estimation of total loss of tomato fruits (including wilt which is very serious; mites; blossom-end rot; Fusarium rots; Phoma rot, etc.) is variable, from 15 to 30 percent.

MALTA:

Slight, almost negligible.

NETHERLANDS:

Loss estimated in severe blight years 50 to 80 percent; in moderate blight years 10 to 20 percent.

NORTHERN IRELAND:

Amount of damage caused by tomato late blight is insignificant on account of the negligible amount of the crop grown out-of-doors.

NORWAY:

Amount of damage not known. Tomatoes grown in the open and in non-heated houses are not an important crop in Norway and the losses consequently are of minor economic importance.

REPUBLIC OF IRELAND:

In the years favourable to the disease the entire crop may be lost. In years of moderate infection, one-quarter of the crop may be blighted.

SCOTLAND:

In years when potato blight is rampant, only small losses occur to tomatoes under glass. Loss is almost negligible in years of slight to moderate potato blight.

SPAIN:

In the south of Spain and partially in the east (Levante) the greater damage is done in the rainy springs. The summer tomato is not generally affected, not only because of the dryness, but also because the temperatures are sufficiently above the optimum and sometimes over the maximum.

At Castilla and Aragon, in the center of Spain, the tomato is cultivated in summer and Phytophthora attacks are rare due to the high temperature and low humidity of the atmosphere.

Conversely, in all the northern Spanish regions and in the cold inner zone of the Iberica Peninsula, the summer tomato cultivations can be the most affected by Phytophthora.

SWITZERLAND:

The heaviest attack we had during the last years occurred in 1951. The losses in untreated plots in our Research Station were 8.8 percent by number of fruits, 5 percent by weight. This is a rare exception, indeed, as generally the losses are of no economic importance. Only some of the first-ripening tomatoes close to the soil usually are infected. This might be in connection with the heavy rainfalls we have in June and July. In the later summer and in the fall when precipitation diminishes there is no more danger of infection.

YUGOSLAVIA:

Generally speaking, damage caused by late blight on tomato plants is not important. In years of severe blight the amount of damage caused by this disease in some parts of our country is 50 to 60 percent and in years of moderate infection it is about 10 to 20 percent.

Control Measures; Effectiveness of These Measures

CYPRUS:

Owing to the sporadic appearance of the disease, no regular control measures are practised but copper sprays and dusts are applied when necessary.

DENMARK:

Spraying with Bordeaux mixture has good effectiveness.

ENGLAND:

Frequent spraying during the summer with officially approved copper fungicides, when efficiently applied and suitably timed, gives very good control. This is a routine practice on most well-managed outdoor holdings. As a general rule it is sufficient to begin spraying in early August, 3-4 weeks later than potato spraying for the same areas.

FINLAND:

According to the literature from abroad, spraying with Bordeaux mixture or zineb is recommended as an aid in controlling late blight.

GERMANY:

The disease may be readily controlled by means of copper sprays. Two or, in cases of severe attack, more than two applications of copper sprays (for example, 0.3-0.5% copper-oxychloride with a 50% copper content, or red-copper (copper-oxydul) preparations) are recommended, beginning the middle or end of June, depending on weather conditions, and continued at intervals of 3-4 weeks. If the spray is not washed off by frequent rains, as is often the case, as for example this year, the results are usually satisfactory.

IRELAND: See under Northern Ireland or Republic of Ireland.

ITALY:

Bordeaux mixture, 1-1-100, is almost universally employed, with very good results against late blight. In the search for a more efficient, polyvalent treatment, the use of ziram (and more of zineb) is increasing.

JERSEY (Isle of):

Blight in Jersey has been severe in the past but has declined during the last ten years owing to spraying; 10 to 12 applications are required each season.

MALTA:

Spraying with half-strength Bordeaux mixture.

NETHERLANDS:

Copper is recommended. It greatly diminishes losses.

NORTHERN IRELAND:

It has not been necessary to advocate control measures, but spraying with a copper fungicide would undoubtedly prove effective.

NORWAY:

Two to three applications of Bordeaux mixture or a fixed copper or zineb usually control the disease on tomato.

REPUBLIC OF IRELAND:

Spraying with Bordeaux mixture or other copper compounds. Little information on the effectiveness of these sprays owing to the very limited outside cultivation of tomatoes.

SCOTLAND:

On the rare occasions when control measures have been asked for, spraying with Bordeaux mixture has been advised and used with, we believe, success.

SWEDEN:

For control the same measures used for the control of potato blight are recommended. The growers of outdoor tomatoes are not yet very acquainted with this disease and so mostly do not do anything about it.

SWITZERLAND:

We obtained the best control with captan (Orthocide) 0.5% and Bordeaux mixture 1%. Dichloro-naphthoquinone and zineb were less effective and TMTD was insufficient.

YUGOSLAVIA:

We are advising application of Bordeaux mixture. Its use gives good results if this application has been done in due time. The control measures against this disease are applied only in certain parts of our country.

Strains; Varietal Resistance

CYPRUS:

Cyprus has no information available recording the existence of strains.

DENMARK:

We do not have anything on the existence and numbers of strains of Phytophthora infestans on tomatoes. This year there were tested different samples of potato leaves from different parts of Denmark. Three potato strains were found this year: 0, 1, and 4 according to the International System.

ENGLAND:

We have no definite information about strains of the fungus occurring on tomato (the strains found on potatoes are fairly well-known); nor have we any evidence on varietal resistance in tomato.

FINLAND:

Strains of Phytophthora on tomato have not been studied; nor the varietal resistance of tomato.

GERMANY:

So far as we know, tomato is especially susceptible to a form of Phytophthora limited to this host; however, "potato-races" can also be transmitted to tomato. Further specialization of "tomato-races" or appreciable differences in susceptibility of various tomato varieties are unknown to us.

IRELAND: See under Northern Ireland or Republic of Ireland.

ITALY:

The existence of a number of strains of Phytophthora infestans in Italy has been ascertained.

JERSEY (Isle of):

With reference to the crossing of the disease from tomato to potato, there is evidence for the existence of varietal strains of the fungus. [Cf. Small, T. 1938. The relation between potato blight and tomato blight. Ann. appl. Biol. 25: 271-276; and, Small, T. 1952. Tomatoes in Jersey. Jour. Ministry Agric. 58: 576-579.]

MALTA:

No evidence of varietal strains.

NETHERLANDS:

Miss de Bruyn succeeded in proving that the tomato strain of Phytophthora can be obtained by passage of the "common" potato strain through tomatoes.

There is no evidence of physiologic races within the tomato Phytophthora. Data on host resistance is not available owing to the unimportance of outdoor tomatoes.

NORTHERN IRELAND:

Until recently we have not investigated the number of strains of Phytophthora infestans occurring in Northern Ireland although this is a problem now receiving attention. We know that most of the common strains of the fungus which cause potato blight are present but so far we have no information as to the exact status of the strains responsible for late blight of tomato and we are, therefore, unable to provide information on the varietal host relationship.

We also have no information as to varietal host resistance.

NORWAY:

Studies on strains of Phytophthora infestans in Norway are now in progress, but so far no data are available.

Varietal differences in host resistance was reported only once. [Cf. Ramsfjell in Aktuelt i grønsakdyrkinga, Oslo, 1952.]

REPUBLIC OF IRELAND:

There is no information on the existence of different strains of Phytophthora infestans, nor on varietal resistance.

SCOTLAND:

Phytophthora infestans exists in Scotland in five strains. No information exists as to varietal differences as regards tomato crops in Scotland.

SWITZERLAND:

It is obvious that varietal resistance exists but no experimental work has yet been done in our country.

YUGOSLAVIA:

We have no information on the existence and number of strains of Phytophthora infestans on tomatoes for we have not worked on this problem in Yugoslavia.

We have no data, also, on varietal host resistance.

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First Report

ALGERIA:

No record of first appearance.

ANGOLA:

Phytophthora infestans does not exist in the Province of Angola; and has not been observed. Very rarely do members of the Peronosporaceae occur in Angola.

BELGIAN CONGO:

No record of late blight on tomato.

BRITISH CAMEROONS:

Phytophthora infestans was found on leaves of tomato in 1953.

EGYPT:

Late blight was reported on tomatoes for the first time in Egypt in December, 1948.

FRENCH SOMALILAND:

No record of the disease.

FRENCH WEST AFRICA:

Phytophthora infestans has never been found up to the present time in French West Africa -- Mauritania, Senegal, Black Soudan, High Volta, Guinea, Ivory Coast, Dahomey as well as Togo.

The ordinary tomato is not cultivated except around the large centers for the revictualing of Europeans; the African tomato (Lycopersicon cerasiforme), cultivated at the end of the rainy season by the Africans, is resistant to cryptogamic infections.

GOLD COAST:

No record of Phytophthora infestans being observed on tomato in the Gold Coast.

KENYA:

Late blight was first recorded in Kenya in 1941 and attacked both potatoes and tomatoes.

LIBERIA:

Tomatoes are often severely ravaged by wilt, whether Phytophthora infestans-induced or not is not known at this time. The impression is that the wilt-causing trouble is caused by a soil-borne organism and is probably bacterial in nature.

LIBYA:

Think it has been present in Libya for many years.

MADAGASCAR:

No late blight has ever been seen in Madagascar, neither on tomato nor on potato, nor any other host of Phytophthora infestans.

Tomatoes are grown everywhere in our Island, but only on a small scale in gardens.

MAURITIUS:

In 1930; but probably existed long before.

MOÇAMBIQUE:

The first record was in 1951.

MOROCCO:

The first notice of Phytophthora infestans on tomato was in 1931. It probably existed in the country for an exceedingly long time, but the absence of our specialized service until 1927 does not permit us to furnish the information more precisely.

NIGERIA:

Phytophthora infestans not noted on tomato in the vicinity of Ibadan, Western Province of Nigeria.

NORTHERN RHODESIA:

No late blight of either tomato or potato has been encountered, due entirely to absence of favorable weather conditions.

NYASALAND:

No record of Phytophthora infestans on tomato.

RÉUNION:

It is not possible to indicate at which date late blight was found for the first time in Réunion.

G. Bourriquet, at the time of carrying out a mission to Réunion in October, 1932, did not find Phytophthora infestans on tomato but only on potato [cf. Bourriquet, G. Rapport phytopathologique sur un voyage d'étude effectué à la Réunion en Octobre 1932. Revue Agricole de l'Ile de la Réunion, Janvier 1934].

SIERRA LEONE:

Phytophthora infestans has not yet been recorded in Sierra Leone on tomato or on any other host plant.

SOMALILAND PROTECTORATE:

No record of first observation.

SOUTHERN RHODESIA:

Typical late blight on tomato has not yet been recorded in Southern Rhodesia, apart from two or three isolated instances of tomato fruits being attacked by Phytophthora infestans when growing immediately alongside heavily infected potato plants.

No tomato foliage or stem infections by late blight have been seen or reported.

SUDAN:

Phytophthora infestans has not been recorded on tomato in the Sudan although there is a record of it on potato in the extreme southern Sudan where the annual rainfall is high. Not of economic importance since potatoes are only occasionally cultivated.

TANGANYIKA TERRITORY:

First recorded in Northern Province, October, 1944.

TANGIER:

No record of first appearance.

TUNISIA:

No tomato growers have ever made a statement to us (Service Botanique et Agronomique, Ariana) of the notorious havoc produced by Phytophthora infestans; the Service itself has rarely observed attacks of mildew.

UGANDA:

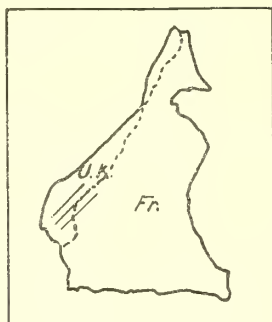
Never recorded for Uganda.

UNION OF SOUTH AFRICA:

There was one report in 1922. The disease then apparently disappeared and was not reported again until 1952.

Distribution

BRITISH CAMEROONS:

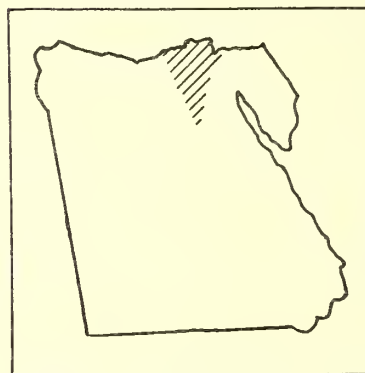


Cameroons
(Van der Grinten's Proj.
632 miles to the inch)

Spread across the Bamenda Province in 1952 on potato; occurred again in 1953 from whence [we] assume the spread to tomato leaves.

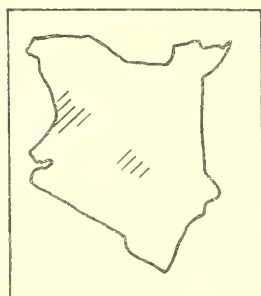
EGYPT:

The distribution of tomato late blight in Egypt follows the shape of an inverted triangle -- the two base points being Alexandria in the west and near Port Said in the east with the apex of the triangle at El 'Aival.



Egypt
(Van der Grinten's Proj.
395 miles to the inch)

KENYA:



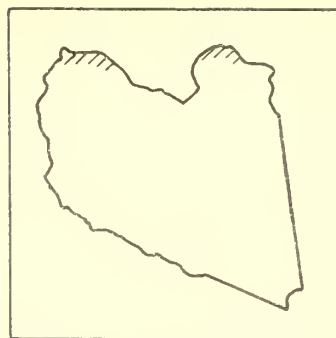
Kenya
(Van der Grinten's Proj.
395 miles to the inch)

The disease is now distributed wherever the crop is grown in the Kenya Highlands. We have had no definite records of it from the Coast. The Highlands are separated from the Coast by about 200 miles of semi-desert.

LIBYA:

We can consider, in general, the farms and oasis gardens of the coastal zone of Tripolitania to be affected by the disease (i.e. from Zuara to Misurata to a depth of an average of ten to fifteen miles from the coast). In Cyrenaica, similarly, it has been observed in the Benghasi, Derna and Barce areas.

Libya
(Van der Grinten's Proj.
632 miles to the inch)



MAURITIUS:



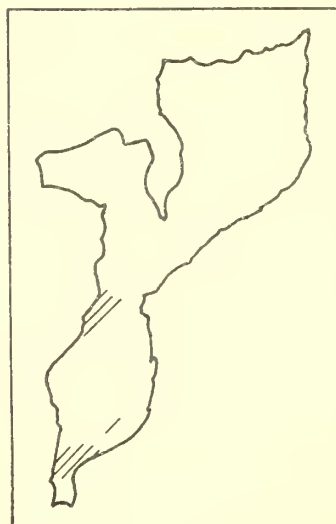
Mauritius
(75 miles to the inch)

Widespread throughout the Island,
but more severe in upland areas.

MOÇAMBIQUE:

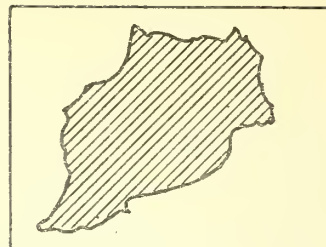
Phytophthora infestans has been reported on tomato from the following places in the Colony of Moçambique: Vila de Manica in the west; and from Umbeluzi, Namaacha, Catuane, Chongoene, Manhica, Infulene, and Catembe in the south.

Moçambique
(Van der Grinten's Proj.
395 miles to the inch)



MOROCCO:

Tomato mildew is distributed throughout all of Morocco. It is especially injurious near the shores of the Atlantic on account of the high moisture and the persistent fogs. Here, more than elsewhere, is found the more important cultivation of tomatoes (cultivation of the first crop for exportation).



Morocco
(Van der Grinten's Proj.
395 miles to the inch)

REUNION:

Réunion
(75 miles to the inch)



Late blight of tomato is seen very frequently in the region of the Plaine of Cafres, Tampon, and sometimes in La Montagne, in years of high humidity.

SOMALILAND PROTECTORATE:

Tomato blight has been observed in gardens developed around wells; this particularly during the two still, moist periods during the change of the Monsoons.

TANGANYIKA TERRITORY:

All over the Territory.

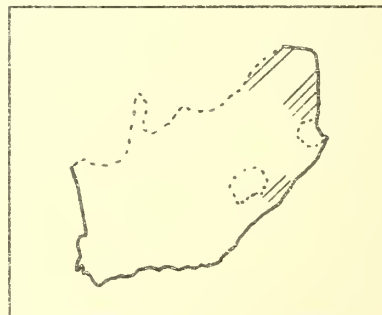
Tanganyika Territory
(Van der Grinten's Proj.
395 miles to the inch)



UNION OF SOUTH AFRICA:

It is now present wherever tomatoes are grown. Most families grow a few tomatoes in their vegetable gardens at home. [Cf. Wager, V. A. 1952. Late blight in tomatoes. Farming in South Africa 27: 333-334, 336.]

Union of South Africa
(Van der Grinten's Proj.
632 miles to the inch)



Spread; Environmental and Geographic Factors Involved;
Potential Danger Spots

ALGERIA:

Phytophthora infestans is very common in the plantations of tomatoes in the different regions of Algeria where this plant is cultivated.

BRITISH CAMEROONS:

Phytophthora infestans appeared in the French Cameroons in 1951 on potato, possibly carried over from Europe in imported seed tubers; disease started near the French boundary and spread across the Bamenda Province in 1952. In 1953 the first crop was attacked and the fungus was also found on tomato.

EGYPT:

Observations indicate that Phytophthora infestans may be transmitted from one region to another through movement of infected tomato and potato plants; under favorable weather conditions epiphytotics may occur in the newly infested area.

In February, 1942, with a long period of rainfall, high humidity, and low temperatures, late blight appeared suddenly and destructively on tomatoes over a wide area of the Nile Delta, up to the Giza Province.

In Upper Egypt, beyond the Giza Province, weather conditions were not favorable and there were no commercial acreages of potatoes so that the disease did not appear on tomatoes in the winter crop.

KENYA:

It is assumed that spread is locally by wind and water droplets and by wind-borne sporangia over considerable distances. Apart from high temperature and desert conditions, there would appear to be no physical barrier influencing its spread or limiting its distribution.

The potential danger spots are the whole of the Highlands. The forest areas up to 800 to 900 feet carry perennial woody species of Solanum which are infected with Phytophthora infestans [cf. Nature 168: 85. 1951. New hosts of Phytophthora infestans in Kenya].

LIBYA:

The micro-climatic conditions have an important influence upon the development of the disease. High humidity and dews in irrigated farms encourage its development. Hot dry winds from inland reduce it.

MAURITIUS:

Disseminated by wind.

MOÇAMBIQUE:

In the lowveld tomatoes can only be grown in the winter as the summer temperatures are so high as to make cultivation of this vegetable nearly impossible.

In the winter the air is very moist, and during the night the mist and dew are very heavy. When the temperature falls very quickly, even only for one night, it is enough to aid the start of the disease.

The most dangerous spots are the valleys of the rivers where the mist forms during the night.

MOROCCO:

This disease, relatively secondary in Morocco, has not been studied scientifically in this country; the means of dispersion probably offers nothing in particular here; they are very similar to what you would find elsewhere.

In this country, in the main arid, the distribution of the disease is governed principally by the humidity of the air. That is why it is especially to be feared in the plantings on the Atlantic shore.

Serious epiphytotics are produced in the spring (February, March, April) and are dependent upon the not infrequent conjunction of favorable climatic factors: sufficient temperature, high atmospheric humidity, and rains. In exceptional cases the disease appears in the autumn.

RÉUNION:

Humidity and heat seem to be the factors which favor the development of the malady. Modes of carry over and of distribution of the spores are not known in Réunion.

SOMALILAND PROTECTORATE:

Believed to spread in the slow-moving moist air.

TANGANYIKA TERRITORY:

Rather guesswork, but as there are almost certainly potatoes growing (as crops or from ground-keepers) in one stage or another at all times of the year, tomatoes can become infected by wind-borne spores. There may be indigenous weed hosts but that is not proved in Tanganyika. Most of the records of blight are from the higher, cooler areas where tomatoes are usually grown.

TANGIER:

The disease appears slowly towards the 1st of July on plantings nearing the end of production. The disease is never very extensive because: (1) there are practically no rains from June 15 on; and (2) irrigation in the Zone of Tanger is very curtailed and is done by gravity and not by sprinkling (not any irrigation by spurt or by pipe).

TUNISIA:

It seems, in a general way, that Phytophthora infestans is not spread in Tunis in an episodic manner and that it does not constitute a subject of inquietude for the cultivators.

UNION OF SOUTH AFRICA:

It was presumably introduced in the first place in seed potatoes from Europe. (The disease has been present in our potatoes for very many years).

We assume that late blight is spread among the tomatoes by the wind. Since 1952 the disease has been present all the year round in South Africa. All areas in which tomatoes are growing at the time are, therefore, potential danger spots for other areas where tomatoes will be grown later.

Here I should mention that within the cooler regions there are several warmer or even subtropical areas as, for instance, on the northern side of the Magliesberg range of mountains near Pretoria. On the southern slopes tomatoes cannot be grown for four or five months of the year, whereas on the other side of the mountain frost is almost unknown and tomatoes are grown during the colder months.

Damage

ALGERIA:

The disease never reaches economic importance.

EGYPT:

In severe blight years the damage may reach 90 percent of the crop and can be estimated at 6 million pounds (the Egyptian pound = 2.87 dollars). In years of moderate infection 10 percent damage, estimated at 600,000 pounds, may occur.

LIBYA:

The damage caused by this disease is negligible because the attacks are generally limited and occur at a late stage. Some damage has been observed from August to November on fall crops but no attacks have been observed on spring crops.

KENYA:

In severe blight years Phytophthora infestans may bring about total destruction of the crop.

In years of moderate infection some crops may escape entirely according to location but if attacked at all, loss of fruit usually ensues.

MAURITIUS:

Severe losses on improved varieties.

MOÇAMBIQUE:

During the biggest outbreak of 1951 nearly all the plants were killed in some days' time and only 10 percent of the fruits could be marketed.

During 1952 and 1953 the disease caused only a small decrease in production because it was not so widely spread.

MOROCCO:

On the whole, damage is not important; the important attacks occur in the spring from February to April on plantings of the first crop, for export. Losses are never estimated.

RÉUNION:

Late blight sometimes produces havoc. It was very conspicuous in La Montagne in 1951; in 1953, the havoc was equally important in the region of the Plain of Cafres and of Tampon.

Attacks of Phytophthora infestans are especially severe during the summer months, November-December, January-February, corresponding to periods of high humidity and of heat.

In years of severe infection the crop, perhaps, is completely lost if the treatments are not practiced in time and repeated frequently. In years of moderate infection, losses are again rather evident.

Tomato cultivation is now limited to higher altitudes because of the presence of the insect, Antherigona excisa Thom, which causes enormous damage to crops in the coastal zone.

SOMALILAND PROTECTORATE:

Phytophthora infestans is nowhere really serious as vegetable growing is not of great importance in this country.

TANGANYIKA TERRITORY:

Complete destruction of plants, and no crop. The disease in both potato and tomato appears to be much more severe here than in Great Britain, for example.

More observations would be required to estimate losses in years of moderate infection. However, I think all years so far in this Territory have had more than moderate infection with corresponding losses of crop.

TANGIER:

Plantings lightly watered grow poorly but are almost always free from disease. Cf. also note under "Spread, etc."

UNION OF SOUTH AFRICA:

We have no figures on damage, but the disease commonly causes up to 80 percent loss in fields where no control measures are applied.

Control Measures; Effectiveness of These Measures

ALGERIA:

This disease is regularly fought with Bordeaux mixture and in recent years with zineb and captan. Cf. also note under "Damage".

EGYPT:

Dithane, Bordeaux mixture, tribasic copper sulphate, Fernide, Perenox, and Parzate were used and checked late blight of tomatoes. However, Dithane Z-78 and Bordeaux gave outstanding results.

KENYA:

Can be controlled by repeated applications of copper sprays. Dipping the seedlings at the time of transplanting is recommended.

LIBYA:

Owing to the weak development of the disease, the use of anti-cryptogamic products is not recommended. When necessary, use of cupric treatments (Bordeaux mixture or copper chloride) is recommended.

MAURITIUS:

Spraying with copper fungicide has been proved to be effective.

MOÇAMBIQUE:

In an experiment on spraying with fungicides, we found that Dithane Z-78 was the best product, compared with Blitox (copper oxychloride), Perenox (copper oxide), and Bordeaux mixture (0.5-0.5-100 and 1-1-100).

MOROCCO:

Organic fungicides have recently been put to trial. No significant differences have been found among them, nor between them and the copper fungicides. It has been proved, however, that the organic fungicides favor very vigorous growth, resulting in a very abundant crop. They are, therefore, recommended. But the practical results from treatments depend essentially on the timeliness and speed of application.

A warning service is necessary but does not exist.

REUNION:

Control measures are applications of Bordeaux mixture started 1 to 2 weeks after transplanting and continued until harvest.

It is difficult to estimate the extent to which control measures are used.

SOMALILAND PROTECTORATE:

No attempt has been made to control tomato late blight although it has been found here that weekly spraying with Perenox commencing after the formation of the first flower provides a measure of control. Cf. also note under "Damage".

TANGANYIKA TERRITORY:

We advocate copper sprays, applied from an early stage and whenever weather is conducive to blight. Several treatments are necessary, and their effectiveness has been demonstrated. We advise that enclosed damp conditions and close planting be avoided.

TANGIER:

No method of control is employed. The net cost of treatment with copper salts would burden the budget of Moroccan agriculturalists without producing appreciable yields.

UNION OF SOUTH AFRICA:

In the subtropical regions the disease is common in tomato seedbeds. Weekly sprayings with a copper-containing fungicide, or with zineb in areas where there is a tendency for the plants to suffer from a zinc deficiency, e.g. certain parts of the Transvaal Lowveld, are recommended. In the cooler regions the seedbeds are seldom attacked by disease.

After planting out, tomatoes usually remain healthy until about one third full-grown. Treatment against disease is, therefore, seldom necessary until about the time that the first fruits begin to form. Growers are then advised to spray weekly against Septoria leafspot and Early Blight which usually make their appearance at about this time. These weekly sprayings -- later changed to dustings as the plants become more dense -- are to a greater or less extent also effective against late blight which may make its appearance at any time, usually more severely as the season advances and the plants become bigger.

Because the copper fungicides are comparatively cheap, we recommend their use, notwithstanding their slight adverse affect on the plants. If necessary, we suggest the alternate use of the copper and zineb fungicides.

Strains; Varietal Resistance

EGYPT:

We think that late blight of tomatoes in Egypt is caused by two strains of Phytophthora infestans; the potato strain and the tomato strain.

No varietal host resistance has been studied up to now.

KENYA:

Five races of the fungus attacking potatoes have been identified by Dr. Black. They are Black's races A, C, D, G, H. Race E occurs in Tanganyika and probably also in Kenya.

We have no knowledge of any tomato varietal host resistance.

LIBYA:

We have no information about the number of strains of Phytophthora infestans here, or of varietal host resistance to it.

MAURITIUS:

No information is available on strains of Phytophthora infestans. The "cherry tomato", locally known as "pomme d'amour", is considerably more resistant than the improved varieties. This type of tomato, however, has an inferior flavour.

MOÇAMBIQUE:

We do not know yet the number of strains of Phytophthora infestans that occur in Moçambique but we want to study them in the future. In 1951 the variety "San Marzano" proved to be more resistant than the variety "Comet".

I think that in 1951 it was a new strain, imported in seed potatoes, that produced the big outbreak of the disease.

MOROCCO:

Nothing is known about the existence of races of Phytophthora infestans; no varieties of potato have been assayed.

TANGANYIKA TERRITORY:

The only strain actually identified from tomato in Tanganyika is I. From potato three strains have been identified: two of these are E found in 1948, and H found in 1954. Definite information is that E occurred in Dr. W. Black's "seedling" 914a (91) which was known to be resistant to A and C; H appeared in Dr. Black's 1792a (3).

TANGIER:

The question of races of Phytophthora in the Zone of Tanger has not been studied.

UNION OF SOUTH AFRICA:

On potatoes, races 0, 1, and 1, 2 in the new potato blight nomenclature (Cf. Euphytica 2: 173-178. 1953) have been demonstrated. On tomatoes only strain 0 has been demonstrated but no extensive survey has yet been made.

All varieties appear to be equally susceptible, but in one instance several rows (± 20) of San Marzano escaped infection when planted with several rows (± 30) of (?) Pearson on either side.

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ASIA

First Report

ADEN PROTECTORATE:

Late blight of tomato has not yet been noted or identified. The growing of tomatoes in the Protectorate is a fairly recent introduction.

CEYLON:

Phytophthora infestans recorded on fruit and leaves of tomato in 1906 from an estate in Lindula (5,000 feet); again recorded on leaves of tomato in 1941 from Balangoda (3,500 feet).

The tomato is grown in Ceylon more as a home garden crop and not on a commercial scale.

FEDERATION OF MALAYA:

No record of the first occurrence of Phytophthora infestans on tomato; first observed on potatoes in the highlands in 1934.

INDIA:

Mentioned in the literature [cf. Mem. Dep. Agric. India, Bot. Ser. VII, No. 3, 1915] that it worked havoc with the potato and tomato crops in Rangpur [Bengal = Pakistan now] in the year 1912-13.

Possibly ? present in the Nilgiris as early as last decade of nineteenth century.

IRAQ:

Phytophthora infestans on tomato has not been found (up to the present time) in Iraq.

ISRAEL:

Phytophthora infestans first recorded on tomatoes in Israel in May, 1927 at Tserifin (near Ramle, Lydda District) and at Nahalal (western plain of Esdraelon).

JORDAN:

No records exist of the first date of appearance; agreed by workers that it has been present for a long time.

MALAYA: See under Federation of Malaya.

PAKISTAN:

Phytophthora infestans does not appear to have been recorded so far officially.

It is possible that this disease may be present to some extent in hilly tracts like Murree Hills, Abbottabad, and Quetta and probably some places in East Bengal [for which latter see INDIA].

SYRIA:

Date of first appearance not known.

THAILAND:

Late blight of either tomato or potato is not present in Thailand. Neither crop is extensively grown.

TRANS-JORDAN: See under Jordan.

TURKEY:

Disease not yet found in Turkey; a Phytophthora sp., causing a fruit rot of tomato in Ismir (Smyrna) on the western coast of Asia Minor, has not been recorded from other parts of Turkey.

Distribution

CEYLON: See with India.

FEDERATION OF MALAYA:

Phytophthora infestans [on potato] is limited to the highlands (4,000 to 6,000 feet above sea level) where the total land under cultivation at present amounts to only a few hundred acres. Tomato is grown only on a small scale.

Malaya
(Van der Grinten's Proj.
395 miles to the inch)



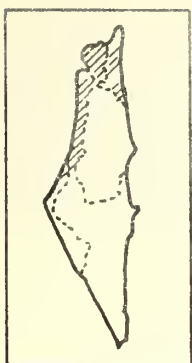
INDIA:



India
Pakistan
Kashmir
Ceylon
(Van der Grinten's Proj.
632 miles to the inch)

Phytophthora infestans recorded occurring in Pusa (Bihar), Rangpur (East Bengal = now Pakistan), Calcutta (West Bengal), Jalpaiguri and Jorhat (Assam), Himalayas and Khasi Hills (Assam). [Cf. Butler and Bisby. "Fungi of India"]

ISRAEL:



Israel
(Chamberlin Trimetric Proj.
118.4 miles to the inch)

Owing to the varying dates on which tomatoes are planted in different parts of Israel, the seasonal occurrence of *Phytophthora* blight varies with the areas involved. All summer crops are sown directly into the field in late April and May, or are planted out in May and June. On these crops blight appears sometimes in June. It is very unusual to find blight developing in spring or summer plantings after the beginning or middle of July.

Late blight of tomato is distributed in the Upper Jordan Valley, Beisan Valley, and the Eastern Valley of Esdraelon, all at elevations below sea-level. It appears also in the Southern Coastal Plain area and in the Sharon and Emek Hefer districts.

Late blight has never been recorded on tomatoes in the Lower Galilee, the Western Galilee, the Haifa Bay area or the central Plain of Esdraelon; only very rarely on

autumn plantings in the Western Valley of Esdraelon.

Blight has been variously recorded in the Huleh Basin but not in the Upper Galilee.

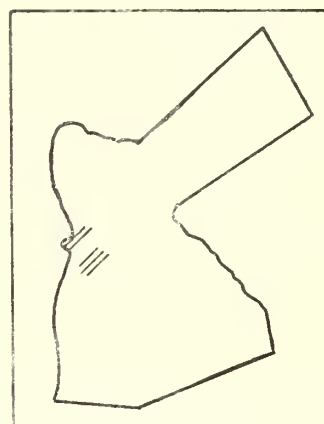
Blight has not so far been recorded in the large and climatically heterogeneous area of Hanegev, which is only now being brought under intensive cultivation and few observations have so far been made on tomatoes.

MALAYA: See under Federation of Malaya.

JORDAN:

The distribution of late blight in the Jordan districts is general, the variations being geographic and seasonal. In the Jordan Valley, below sea level, the winter months are the months of severe infection, and on the uplands, above sea level, it is June to September, inclusive, that are the serious tomato blight months. However, that does not mean that some late blight does not exist in the Jordan Valley during the summer nor that some does not exist on the uplands during the winter. But late blight follows the pattern of intensive culture of the tomato.

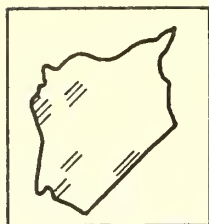
Jordan produces some 35,000 tons of tomatoes each year. Of the 35,000-tons some 40 percent are produced in the Hebron area some 800 to 1000 meters above sea level. About 30 percent are grown at the Ghor El Mazra, a fan shaped alluvial plain spreading out into the Dead Sea from Wadi Kerak and varying from 350 to 320 meters below sea level. The two areas are not competitors as the Ghor El Mazra is a winter production center and Hebron a summer area. The remaining 30 percent of production is rather evenly distributed over the rest of Jordan.



Jordan
(Chamberlin Trimetric Proj.
118.4 miles to the inch)

PAKISTAN: See with India

SYRIA:



Syria
(Van der Grinten's Proj.
395 miles to the inch)

Late blight of tomato occurs in Syria in the following places: in the southwestern part of the country around Damascus and near the eastern border of Palestine; in the northwestern part of the country along the shores of the Mediterranean Sea, along the banks of the Nahr El Asi, and around Aleppo. It is also found in the southern part near the border between Jordan and Iraq.

Spread; Environmental and Geographic Factors Involved;
Potential Danger Spots

FEDERATION OF MALAYA:

The means of spread of Phytophthora infestans have not been studied in this country, nor its host range.

Late blight does not occur on lowland, probably because of the tropical climate and also possibly because no potatoes and very few tomatoes are grown there.

INDIA:

The disease has never been widespread and serious as the causal organism is mostly confined to the sub-Himalyan region and has been recorded only rarely in the plains even on potato, owing to unfavourable weather conditions.

The tomato as an agri-horticultural crop is a very recent development in India.

ISRAEL:

We have no information on the means of spread.

The environmental factors involved in the spread are several:

1. Rains. The date of appearance of blight in November-December in the various parts of the country appears to be related to the date of the first winter rains. No analysis of data to examine this relationship, or that of blight development and rainfall throughout winter and early spring, has ever been made here.

2. Morning Mists and Dew. The occurrence of Phytophthora infestans on spring and summer tomatoes from late April to July is regular and annually recurrent only in the Sharon and Emek Hefer districts of the Coastal Plain, where morning mists are frequent and dews heavy during these months.

3. Topography and Shade. The effect of these factors is particularly evident in the low valleys in winter. The Eastern Valley of Esdraelon is bordered by steep mountains on its south side. Tomatoes grown on these slopes (facing north) in winter are shaded by the mountains up to about 10 a.m. Such plots are always the first to be attacked and the hardest to protect of all plots in the Valley. Even trees or other tall objects may greatly speed up blight development in these valleys if they border plots on their southern side and thus provide extra shade during the morning hours of winter days. In one instance we saw that a row of trees of widely varying height which bordered a tomato field in the Beisan Valley on the southern side, was practically "photographed" in that field: opposite the tallest trees the blight penetrated deepest into the field, while opposite the lower trees the amount of blight was proportionately less.

4. Proximity of Blighted Potatoes. Potatoes in winter and spring suffer very severely from P. infestans in most districts of Israel, excluding Hanegev. The proximity of blighted potato fields has frequently been observed to be an important factor in the development of blight in tomato seedbeds (under glass frames) and in tomato fields. Sometimes only those rows of tomatoes that bordered on the potato field were infected.

5. Danger Spots. As particular danger spots we would designate the Upper Jordan Valley in December-March, and the Sharon and Emek Hefer districts of the Coastal Plain in May and June.

JORDAN:

The principal means of spread of late blight in Jordan would probably put the nursery seed-bed first. At present we have no check on the merchants who sell seedling tomatoes and rarely can trace for certain the source of tomatoes after the farmer receives them.

The next important source of infection is the vicinity of the fields in which tomatoes are grown. Rotations are not controlled as yet and few growers are following them. We have a long way to go in getting farmers to accept rotation. They may have what to them are good reasons for not doing so but that does not help the problem. The smallness of the holdings makes rotation of little real value because, do what the farmer will, he cannot get his plants a safe distance from his neighbors.

Potato fields in the same vicinity also add to the source of inoculum. We need resistant varieties, too.

MALAYA: See under Federation of Malaya.

SYRIA:

Factors involved in the spread of this disease in Syria are not yet known.

Damage

FEDERATION OF MALAYA:

Tomatoes cannot be grown in the highlands without regular protection against late blight and there is no variation from year to year.

ISRAEL:

As the various parts of Israel differ so widely in climate and in the seasons of tomato planting, we cannot designate any given year as "severe", "moderate", or "light" for blight attack over the whole country. Thus, severe outbreaks of the disease in winter in the Jordan Valley may be followed by exceptionally light blight development in spring in the coastal plain.

The amount of damage caused by *Phytophthora infestans* on tomatoes can be assessed with any degree of accuracy only in respect of the winter crop grown in the Upper Jordan Valley, the Beisan Valley, and the Eastern Valley of Esdraelon. In these valleys protracted spells of rainy weather in November may induce blight attacks to coincide with the period of maximum host development. In these cases most of the fruit may be lost in the plots attacked at this stage. In the Upper Jordan Valley in 1951-52 the loss of marketable fruit reached about 25 percent of the total crop which equals a financial loss of about half a million Israel Pounds or 300,000 U. S. dollars.

A general estimate of blight damage in other parts of Israel cannot be made, because in most cases blight appearance is sporadic. Even in the Sharon and Emek Hefer districts of the coastal plain, where the disease regularly appears on the spring or summer crop, the amount of damage varies within extremely wide limits, depending on microclimatic factors, the date of disease appearance in relation to planting date, the proximity of blighted potatoes, and the timing and nature of chemical treatments primarily directed against other diseases.

JORDAN:

The amount of damage caused in a severe year will never be as great as it would be in sections of the U. S. of the same size because of the difference in climate here. Practically one-half of the tomatoes are grown below sea level and thus the chances of an epiphytotic spreading, as it would along the Atlantic Seaboard, are greatly reduced.

MALAYA: See under Federation of Malaya.

SYRIA:

The damage caused by late blight on tomatoes is 50 to 70 percent in severe blight years; 10 to 20 percent in years of moderate infection.

FEDERATION OF MALAYA:

Spraying with Bordeaux mixture or Perenox. Under regular spraying schedule tomatoes can be grown relatively free from late blight.

ISRAEL:

In the lower valleys tomato growers are advised not to plant where tall objects or mountains to the south or southeast of the field will shade the latter excessively.

In the coastal plain, where the prevailing wind direction is from the sea (west), growers are advised to avoid the proximity of their spring and summer tomatoes to spring potatoes, as these suffer from blight earlier and more extensively than tomatoes. If this is impracticable, as is the case in many small-holders' settlements, growers are directed to plant their tomatoes to the west, and in no case to the east, of their potatoes to avoid direct transfer of inoculum from the blight potatoes to the young tomatoes by the moist west wind. Occasional east winds are less dangerous in this respect because they are dry.

The control measures generally recommended are zineb sprays (e.g. Dithane Z-78 at 0.2% concentration) for seed-beds and young crops, and either zineb or cuprous oxide sprays (e.g. Perenox 0.25%) for the maturing crop. Phygon XL (at 0.2%) has also given very good results in trials but has not yet been generally introduced. Dusting with zineb or copper dusts is not very satisfactory and is advised only where (a) irrigation is by furrows and not by overhead sprinklers, and (b) no spray can be applied.

The efficacy of chemical control measures depends largely on (a) the weather, (b) the stage of plant development at disease outbreak, and (c) the timing of the control operation. In illustration we may mention the blight outbreak in the Upper Jordan Valley in November-December 1951 -- it was then established that plots planted early (late August, early September) were less affected than those planted later (late September, early October). Under weather conditions extremely favourable to the disease, timely spraying saved most of the earlier plantings, but the later plots were in many cases total losses. In other parts of the country, where the weather is rarely quite so favourable to tomato blight, spraying may be considered generally effective.

JORDAN:

Security measures are recommended as follows: (a) rotation and sanitation; (b) spray with copper fungicides; (c) check seedlings for disease before purchasing them.

MALAYA: See under Federation of Malaya.

SYRIA:

Recommendations for control include: (a) dusting with sulfur at 15-day intervals from the flowering period; (b) use of copper compounds.

Strains; Varietal Resistance

FEDERATION OF MALAYA:

We do not have any information on races of Phytophthora infestans, nor on varietal resistance. Potatoes and tomatoes are not grown thus far in Malaya on any appreciable scale. With only one plant pathologist at a time in this country, investigations of this nature could not be undertaken.

INDIA:

Recent inquiries at Simla (about 7,000 feet altitude) shows that Phytophthora infestans does not usually occur on tomatoes in the Simla Hills although it frequently attacks potatoes and at times very severely. Even during such an epidemic no infection of the tomato plots growing in close proximity of potato fields severely affected with late blight was observed at the Potato Research Substation at Kufri (Simla Hills, altitude 10,000 feet).

ISRAEL:

Studies on strains of Phytophthora infestans have been commenced in 1953. It is too early to draw conclusions from this work. However, it may be stated that so far inoculum taken from potatoes has always infected tomatoes and vice versa. We have not observed any major differences in their reaction to blight between the tomato varieties grown here. The principal variety is "Marmande". "Chatham" is also grown extensively. Both are highly susceptible.

JORDAN:

At present we have no information on the races of Phytophthora infestans in Jordan on tomatoes. Drs. William Black of Edinburgh and C. Mastenbroek of Holland have been kind enough to identify isolations of P. infestans from potato. It is clear that we have two races, i. e. Race 0 and Race 4, based on the International Classification. This knowledge is giving us an opportunity to select potatoes on the basis of the known races of late blight. We hope to be able to do likewise with tomato races also.

MALAYA: See under Federation of Malaya.

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AUSTRALASIA AND PACIFIC OCEAN AREAS
(excepting U. S. territory or possession)

First Report

AUSTRALIA:

New South Wales: In 1910.

Northern Territory: No record.

Queensland: Found in a Brisbane suburb, May 19, 1909.

South Australia: Phytophthora infestans on tomato has never been recorded.

Victoria: In 1911; found previously on tomato fruits imported from the States of New South Wales and Queensland in 1910.

Western Australia: Tomato late blight has not been recorded in Western Australia.

NEW ZEALAND:

First official record in 1905.

TASMANIA:

First reported in the 1952-53 season; probably occurred before then.

BRUNEI:

There are no reliable records of the occurrence of late blight in Brunei.

Cultivation of tomatoes in Brunei is at present very poorly developed; in fact, nothing more than a back garden hobby.

FIJI:

Wilt disease of tomatoes has been reported without naming the causal organism.

INDONESIA:

No record of the first report. Confirmed evidence of the presence of the disease taken from Karthaus, P. J. and Thung, T. H. 1941. The grafting of tomatoes on undercuttings resistant to the slime disease. *Natuurwetenschappelijk Tijdschrift voor Nederlandsch Indië*, dl. 101: 267. (In Dutch).

NEW GUINEA: See under Territory of Papua and New Guinea.

NORTH BORNEO:

Information not available for North Borneo.

"..... the situation with regard to the occurrence of this pathogen will be similar to that obtaining in Malaya..." [q.v. under ASIA]

PAPUA:

See under Territory of Papua and New Guinea.

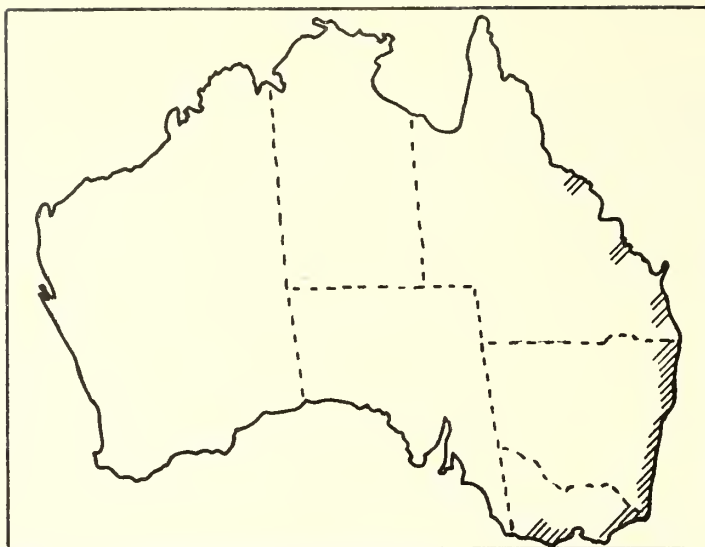
PHILIPPINE ISLANDS:

Tomato late blight observed since 1929 (Mountain Province) although it is believed to have been present some years prior to this date.

TERRITORY OF PAPUA AND NEW GUINEA:

Phytophthora infestans has not yet been recorded on tomatoes in this Territory; even in the Highlands, where conditions would appear to be suitable for development of blight, P. infestans has not been observed on either tomatoes or potatoes.

AUSTRALIA:



Australia
(Van der Grinten's Proj.
632 miles to the inch)

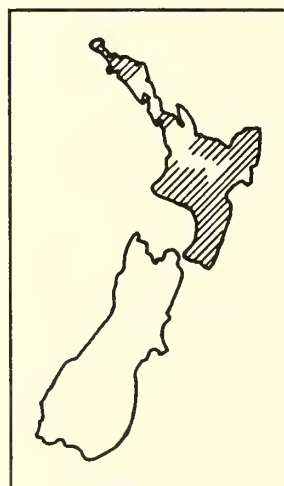
New South Wales: Occurred in all coastal areas (1930); Far North Coast (1954); present each autumn at Mt. Wilson, immediately above the coastal plain and 60 miles west of Sydney.

Queensland: Confined to coastal districts, the centres of recurring outbreaks being Lockyer Valley, Brisbane, Redland Bay, Nambour, Rockhampton (infrequent), and Bowen (rare).

Victoria: Confined mainly to three potato districts, viz.: Warrnambool, Otway, and Southern Gippsland; also potato districts on the southern slopes of Victoria's Central Highlands but outbreaks occur here to a less extent.

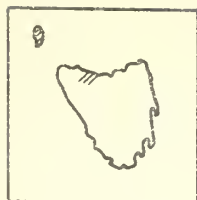
NEW ZEALAND:

Widely distributed over the North Island wherever tomatoes are grown. The area includes Wellington, Manawatu, Wanganui, Taranaki, Wairarapa, Hawkes Bay, Bay of Plenty and Auckland and North Auckland districts. The most important areas for blight are market and domestic gardens in the vicinity of Auckland and Pukekohe (30 miles south).



New Zealand
(Van der Grinten's Proj.
395 miles to the inch)

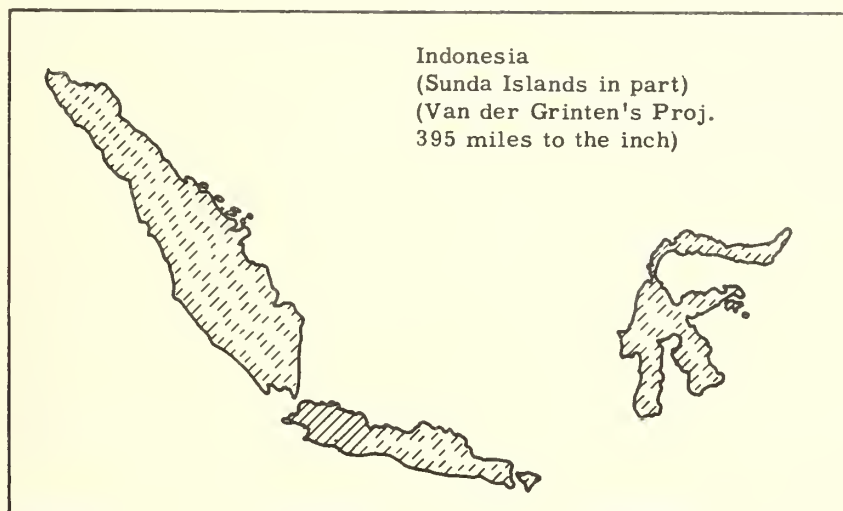
TASMANIA:



Tasmania
and
King Island
(Van der Grinten's Proj.
395 miles to the inch)

Reported on tomatoes at
Ulverstone (Northwest Coast
district) and on King Island in
Bass Strait.

INDONESIA:



Indonesia
(Sunda Islands in part)
(Van der Grinten's Proj.
395 miles to the inch)

Tomato late blight is known to be in West Java. It is reported verbally to be in Central and East Java, Bali, Sumatra, and the Celebes. Probably present wherever tomatoes are grown.

PHILIPPINE ISLANDS:

Present in the Trinidad Valley
and in other localities of Baguio,
Mountain Province.



Philippine Islands
(Van der Grinten's Proj.
395 miles to the inch)

Spread; Environmental and Geographic Factors Involved;
Potential Danger Spots

AUSTRALIA:

New South Wales: Records from 1910 to 1930 are incomplete and no data on serious outbreaks are available. In 1930 a severe outbreak occurred in all coastal areas. The disease was prevalent again in 1931 and 1932 and occurred in epidemic degree throughout the State in 1933. In 1934 and 1935 it was present but not serious in the coastal regions. Afterward it was of no importance until 1939 and 1940, when it caused slight damage. Trace infections occurred between 1940 and 1950, when the disease recurred in epidemic form, to disappear again in 1951 and 1952.

Climatic conditions of the coastal belt are better suited to the pathogen than those of inland areas.

Queensland: Outbreaks appear to be associated with periods of unusually heavy rainfall during the cooler months. They are most frequent and most serious during June and July but have been recorded during the spring months to as late as November. Rain is probably the most important local means of spread. Temperature appears the main factor in distribution. The potential danger spots are the Lockyer Valley and southeast coastal districts.

"... variation in severity of incidence can be correlated with the temperatures and humidities of the growing season in each area." [q.v. under Distribution]. From Aberdeen, J.E.C. 1949. Tomato diseases and their control, Pamphlet No. 138. Department of Agriculture and Stock, Queensland, Division of Plant Industry.

South Australia: In the Pt. Pirie area (and particularly in the irrigation area around Renmark) there probably has never been any serious introduction of Phytophthora and the climate is too dry and warm for the organism to build up to any noticeable proportions.

In the Adelaide region we are rather at a loss to explain the absence of blight on tomato. Even if the potato strain needs, as suggested by Mills and others, to go through the tomatoes for some generations to be very effective on tomatoes, one might expect that the autumn outbreaks in potatoes would infect nearby outdoor tomatoes, or glasshouse tomatoes some 15-20 miles distant. This apparently never happens. It would seem that our winter-early spring temperatures would be reasonably satisfactory for infection and disease development and if this is so, the limiting factors may be the infrequency of 24-36 hours rainfall along the lines suggested by the Dutch workers. This is supported by the frequent occurrence here of very small isolated patches of blight in potatoes whose development has apparently been arrested by low humidity.

NEW ZEALAND:

In these areas [see under Distribution] tomatoes are grown either in glasshouses or outdoors practically all the year round. The main glasshouse plantings commence in June, and further plantings are carried out later for autumn, late autumn and winter crops. In the field tomatoes are planted from September onwards, and the fruit is being harvested until May.

Infection occurs mainly from neighbouring tomato (and potato) crops which are present for most of the year. Infection is also spread from volunteer potato and tomato plants; also from tomato and potato refuse in soil that has grown an infected crop. Infection may occur under New Zealand conditions at any stage of development from young plants in boxes to mature plants in the field. In glasshouse crops the disease is usually of little economic importance, but in some seasons it causes damage to plants in spring and late autumn.

Our climate in the Auckland district is particularly favourable for development and spread of late blight. For the years 1949-53 inclusive, the average rainfall was respectively 43.11, 40.92, 49.58, 52.42, and 65.47 inches. The average relative humidity ranges from 77 percent to 85 percent. Rainfall is fairly evenly distributed throughout the year, greatest from May to August and least from January to March. Temperatures are as follows: Mean maximum 64.8° F.; mean minimum 53.1° F.; mean 58.95° F. -- these are standard air temperatures taken at 9 a.m.

TASMANIA:

Occurs only in the vicinity of infected potato fields.

INDONESIA:

The spread of tomato late blight and the limiting of its distribution seems to be influenced by environmental and geographical factors. Report from an Extension Service Official in Bandung, West Java states: "Late blight is quite severe on the tomato variety Manalucie grown from seed secured at Bradenton, Florida, U.S.A." The disease is reported to be severe during the rainy season extending in West Java from October through March.

"In the plains there is no Phytophthora infestans (until what height above sea level is not known) so that if it were possible to grow tomatoes there, the mildew would at the same time be eliminated." [ibid. reference as above]. However, there is an attempt now being made to cultivate tomatoes on the coastal plain of West Java.

PHILIPPINE ISLANDS:

The disease assumes epiphytotic severity when the weather is cool and wet, ruining the whole field in a few days. All the vegetative aerial parts of the plant, including the fruit, are affected by the disease. (Refers to Mountain Province).

Damage

AUSTRALIA:

New South Wales: When the disease occurs in epidemic form entire areas of unsprayed tomatoes may be devastated but generally late blight is of no economic importance.

Queensland: It is not regarded as an ever-present danger in this State. Serious outbreaks occur only occasionally. Such outbreaks recorded at this office since 1927, with relevant remarks, are:

August, 1927 -- at Bowen. Associated with abnormally wet weather.

June, 1930 -- at Peak Crossing (Lockyer Valley) in stormy weather.

July, 1934 -- At Annerley (Brisbane suburban area), unusually wet season.

June, 1950 -- Beenleigh (near Brisbane), flood rains at the time.

July, 1950 -- Rosewood, Boonah, Grantham, etc. (Lockyer Valley), abnormally wet weather.

Information on total loss involved during these outbreaks is not available. In many years, loss would be practically nil.

"As Queensland winters are normally dry, epidemics of Irish blight are not common in this State." [Aberdeen, J. E. C. cited under Spread.]

Victoria: The tomato industry has developed in warmer and drier areas of the State; consequently, Phytophthora infestans does not present a problem to the growers.

NEW ZEALAND:

If left unchecked late blight would be responsible for at least 50 percent loss of tomato crops in many parts of the North Island. In severe blight years 75 to 100 percent losses would occur in outdoor crops in Auckland district. Actually if the spray programme evolved by this Division [Plant Disease Division of the Department of Scientific and Industrial Research, Auckland] is efficiently carried out, losses would be negligible. At the present time losses would not exceed 5 to 10 percent, due mainly to inefficient application of control measures.

TASMANIA:

Losses are very slight even in years when late blight is serious on potatoes; economic damage is confined to the fruit.

INDONESIA:

No reports are available on the amount of damage caused by tomato late blight.

At certain periods of frequent rains, the fruits cannot be found in the local Pasars (native markets).

PHILIPPINE ISLANDS:

Under severe infection conditions late in the season from 50 to 80 percent of the fruit may be ruined by the disease. (Refers to Mountain Province).

Control Measures; Effectiveness of These Measures

AUSTRALIA:

New South Wales: Though no actual measurements have been made there is no doubt that growers who have followed this Department's recommendation [Biological Branch, Department of Agriculture, Sydney] of Bordeaux mixture (4-4 (Ca(OH)₂-40) have protected their crops to a worthwhile degree. Early blight (Alternaria solani (Ell. & G. Martin) Sor.) occurs annually and most growers of autumn crops apply Bordeaux mixture 2-2-40 as a 10- to 14-day routine. This could account for the low incidence of late blight.

Queensland: Phytophthora infestans of tomato "can be controlled by the use of copper sprays or dusts. Owing to the rapidity with which the disease can spread, the usual practice is to commence application of a fungicide in the seed-bed without waiting for the disease to appear, and to continue treatment throughout that portion of the year in which climatic conditions favourable to the spread of disease may occur. Normally, the interval between applications is 7 to 10 days; this period may need to be shortened if climatic conditions are unusually favourable to the development of Irish blight, whereas during prolonged dry spells it may be increased. As for target spot, it is not advisable to reduce the strength of a dust below 7 per cent. copper. Sprays weaker than the standard 4-2-40 Bordeaux mixture could possibly be used, but thoroughness of application must never be neglected."

Victoria: The only control measure for tomatoes advocated by this Department [Department of Agriculture, Victoria] is the application of a suitable copper dust or spray. However, growers normally take no precautions against late blight.

NEW ZEALAND:

Copper sprays, either Bordeaux mixture 6-8-100 or copper oxychloride 5 lb.-100 gallons, are recommended. It is essential that application is commenced early in the season preferably before plants are set out in the field, and thereafter every 10 to 14 days. The interval between sprays can usually be lengthened in the January-March period, but this depends on weather conditions. If the above schedule is efficiently carried out, late blight is effectively controlled.

TASMANIA:

Special control measures are scarcely warranted under our conditions. We do recommend either 4.2.40 Bordeaux mixture, or 1 lb. of copper oxychloride per 40 gallons (Imperial), but in practice it is rarely, if ever, used on tomatoes.

INDONESIA:

Very little control work is done to prevent or to control tomato late blight. Bordeaux mixture is used in the rather extensive potato plantings in the mountain area around Bandung, West Java. Thung states: "tomato cultivation... is rather expensive because of the need to spray plants with Bordeaux mixture against the above-mentioned mildew."

Strains; Varietal Resistance

AUSTRALIA:

New South Wales: There is no evidence of varietal resistance in any of the commercial varieties of tomatoes grown here. These varieties are chiefly Rouge de Marmandie and Grosse Lisse. No work has been done on strains of the fungus.

Queensland: No information has been obtained here on the possibility of strain differentiation within this parasitic species.

Victoria: During the past three years we have been actively interested in Phytophthora infestans, but there have been no infected tomato plants or fruits from which to isolate the pathogen. Repeated isolations from potato tubers and plants and also field indicator plots have not revealed evidence of more than one potato strain. We have no evidence of varietal host resistance to this disease.

NEW ZEALAND:

Regarding strains of *Phytophthora infestans* present in New Zealand, work is being carried out on this project at the present time at Crop Research Division, Lincoln, Christchurch, in conjunction with breeding for resistance against blight of potatoes. We have the common strain and several others that have not yet been identified.

We have little evidence of varietal resistance of tomatoes to blight in this area. All the varieties grown commercially are susceptible.

TASMANIA:

The Department [Department of Agriculture, Hobart] is currently undertaking a potato breeding programme, in which one of the objectives is late blight resistance. We are also investigating the environmental factors influencing late blight, as the disease is sporadic here and therefore regular preventive spraying is unwarranted. We hope to institute a warning service this season, as work to date suggests that the "Irish Rules" apply under our conditions.

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* - Indicates references furnished by cooperators.

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SOUTH AMERICA

First Report

ARGENTINA:

Mentioned in the literature as found in 1912 causing death of many tomato fruits.

Found at Tinogasta (Catamarca) in 1919 on leaves and stems; on leaves and fruits in Temperley, F.C.S. in 1921.

BOLIVIA:

No record of the occurrence of Phytophthora infestans on tomato; reported, however, to have been isolated from tomato that was grown near Cochabamba.

BRAZIL:

State of São Paulo: Our first record of late blight on tomato is January 20, 1938 in the neighborhood of the city of São Paulo.

Additional records include: First occurrence in 1926 on leaves of tomato from Camassary, Bahia State; 1929 at Vicosá, Minas Gerais State.

BRITISH GUIANA:

Phytophthora infestans on tomato has not been recorded in British Guiana.

COLOMBIA:

Found in 1929 at la Cumbre, a small locality about 1900 meters in altitude, near Cali, Valle Department. [Cf. Chardon and Toro. 1930. Mycological explorations of Colombia. Jour. Agric. Porto Rico 14: 1-369].

Possibly an earlier record for Phytophthora infestans has been noted on potatoes, at the Bogota plain, in 1908.

ECUADOR:

Phytophthora infestans reported on tomato [cf. Molestina, E. 1942. Indice preliminar de las principales enfermedades y plagas de la Agricultura en el Ecuador. Boletin del Dept. Agric. No. 15. 25 pp.] .

PERU:

First (written) report on the presence of Phytophthora infestans on tomato was in 1931 as found in the environs of Lima.

SURINAM:

No record of late blight on tomato in Surinam.

URUGUAY:

Late blight on tomato was reported for the first time in Uruguay in 1944 on samples collected in the vicinity of Montevideo.

VENEZUELA:

First date of appearance unknown.

BRAZIL:



Brazil
(Van der Grinten's Proj.
632 miles to the inch)

Tomato late blight is spread in all tomato districts of São Paulo State. There are records of the disease in the Distrito Federal (Rio de Janeiro), and the States of Minas Gerais and Rio Grande do Sul. It has also been reported from the States of Espírito Santo, Parana, and Santa Catarina.

COLOMBIA:

The disease is known to occur in El Valle del Cauca, Caldas Department, at 1,000 meters elevation and in Antioquia Department. It is probably present in other areas of the country.

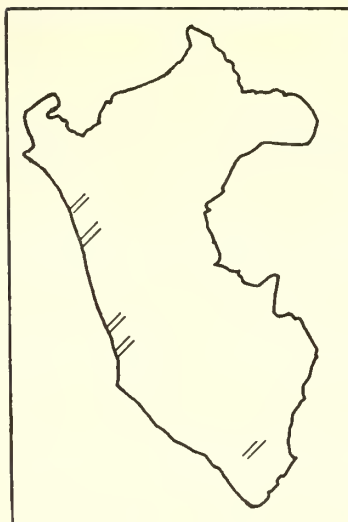


Colombia
(Van der Grinten's Proj.
395 miles to the inch)

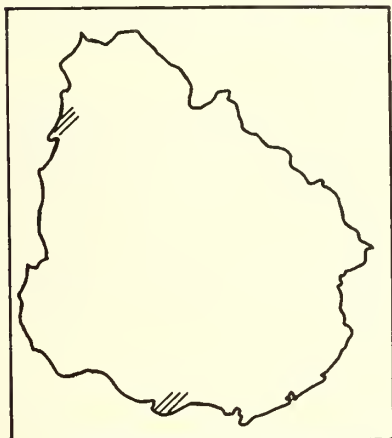
PERU:

Phytophthora infestans on tomato is found in the Departments of Lambayeque, La Libertad, Lima, and Arequipa. It is possibly generally present in the whole of the Sierras in the small plantings grown.

Peru
(Van der Grinten's Proj.
395 miles to the inch)



URUGUAY:



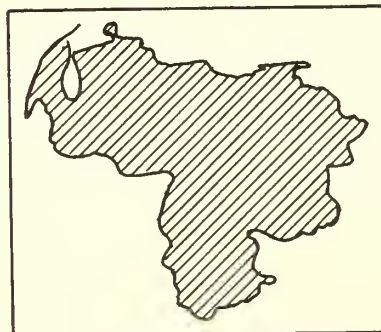
Uruguay
(Chamberlin Trimetric Proj.
126.3 miles to the inch)

Late blight is found in the environs of Montevideo; it is found also on early planted field crops of tomato growing in the neighborhood of the city of Salto.

It has not been reported from other places where tomatoes are grown, probably because they are grown when the environmental conditions are not so favorable for Phytophthora infestans to appear.

VENEZUELA:

The disease occurs in all parts of Venezuela, and, in general, the severity depends upon rainfall.



Venezuela
(Van der Grinten's Proj.
395 miles to the inch)

Spread; Environmental and Geographic Factors Involved;
Potential Danger Spots

BRAZIL:

State of São Paulo: In general, tomato fields have small areas, more or less isolated and not very near potato fields. It is believed the potato late blight is not the principal source of inoculum.

Weather conditions are the factors most important in the spread of the disease. These conditions were studied for the State of São Paulo [cf. Andrade, A. C. de. 1951. Basis for the forecasting of late blight epiphytotics of tomato in São Paulo. *Arquivos do Instituto Biológico* 20: 95-108].

The tomato crop is grown in the open all year round, but the crop is limited in some regions by spotted wilt in summer and in others by drought or frost in winter.

COLOMBIA:

Late blight is spread by wind-splashed rain. The disease is more prevalent at medium elevations, 1000 to 1800 meters. Warm, dry weather seems to check the disease.

PERU:

On the central Peruvian Coast, especially in the Department of Lima, and in the Department of Arequipa, the increase in cultivation of the potato can be one of the factors in spreading the disease. In the Departments of Lambayeque and La Libertad (coast) the fungus possibly is confined to the tomato and other Solanaceae.

The prevailing conditions (high atmospheric humidity and appropriate temperature) are undoubtedly the essential factors for the spread of this disease, to which is added the increase in the cultivation of the potato and, similarly, the tomato.

On the Peruvian Coast, especially around Lima, tomatoes can be cultivated during the whole year. In recent years, however, it has been observed that plantings made in March and April were subject to attack by *Phytophthora infestans* and if the prevailing weather conditions were favorable, 100 percent of the crop was lost. In the plantings made in November and December the disease is not present and the only problem that the agriculturists have is the control of insects (actually controllable).

In the Department of Piura, in the North, perhaps the disease will not be destructive because in the period in which tomatoes are grown, prevailing conditions, low atmospheric humidity and very high temperature, do not favor the disease.

Serious losses could possibly be produced in the Sierras if spread occurs in a period favorable to the disease.

URUGUAY:

The principal means of spread are potato crops. There are no geographical factors able to limit the distribution of *Phytophthora infestans* in this country; the only limiting factors are the weather conditions. The period during which the disease appears in susceptible varieties is during the end of March until November. During the summer months we have never received any records of plants being attacked by the disease. We suppose the principal means of spread are potato crops which in some parts of the country are grown practically throughout the whole year, for example in Rincón del Cerro, near the city of Montevideo.

VENEZUELA:

Rains and fogs greatly favor the spread of late blight. From a geographic point of view, growers located in pocket canyons and valleys that are blocked experience more difficulty, primarily because of less air circulation and correspondingly high humidities with accompanying fogs.

In the central zone (States of Lara, Yaracuy, Carabobo, Aragua, Miranda, and the Distrito Federal) in bottom lands damage is severe if there are unseasonable rains. The States of Lara (northern part) and Falcón (southern part) are essentially dry states almost the entire year and consequently suffer much less than other areas.

Damage

BRAZIL:

State of São Paulo: The damage in severe blight years is about 60 percent of the yield; in moderate infection less than 20 percent of the yield.

COLOMBIA:

No accurate estimates have been made of the losses due to the disease. In (a) severe blight years it is common to observe total losses due to foliage destruction and fruit rotting, and (b) in years of moderate infection there is only a mild attack on the foliage and but little fruit rot.

PERU:

In years of severe infection, in the central Peruvian Coast (plantings in March and April), practically 100 percent of the crop is lost. In the few favorable years, it is limited to light attacks on the leaves.

URUGUAY:

No statistical data have been reported.

VENEZUELA:

There are no figures available for the amount of damage caused in either severe or moderate infection. Very little control is practiced.

Control Measures; Effectiveness of These Measures

BRAZIL:

State of São Paulo: Spraying with Bordeaux mixture, Phygon or Dithane Z-78 gives economical control of the disease. The effectiveness of the control depends on spraying at the right time, i. e. in the period of rain and low temperature. The farmers now are well-informed about the correlation between weather conditions and disease and, therefore, the control of the disease is improving and the claims against its damage are reduced.

For figures of experiments in the control of late blight of tomato, indicating the intensity of the disease as percent of fruits spotted by late blight, cf. Andrade, A. C. de. 1952. Fungicidas modernos para controlar a requeima de tomatero. *Biológico* 18: 6-14.

COLOMBIA:

Cultural practices, like pruning the lower leaves, have given very good results in preventing initial infections.

Spraying with Bordeaux (4-4-50), copper oxychlorides, or Dithane Z-78 is recommended.

In heavy rainy seasons no control is observed even if spraying is done at 6-day intervals.

PERU:

Plantings are made in November and December (coast) to escape the dangerous months (May to September).

In the Sierras, the July plantings possibly escape.

URUGUAY:

We recommend the use of Bordeaux mixture at 1% or any copper oxychloride of 50% copper at 0.5%.

VENEZUELA:

Control is a relative matter. Chemicals are expensive and are generally used only by the larger growers. The "conquero" (squatter) does not use them as a rule.

Until about 1948 Bordeaux mixture was used on both seedbeds and in the field. Since then neutral coppers, such as Copper A, Tribasic, etc., are used. Dosage is 2 kilograms per 400 liters.

As for schedule, the plants are rarely sprayed as a protectant on a regular schedule. Instead, as the disease appears spraying commences. Most growers who spray know that coverage is important, but the job "leaves much to be desired". The carbamates as a rule are not used, primarily because they are more expensive than the coppers.

Some spray experiments have been carried on in the Sanare region of the State of Lara at an altitude of 1200 meters above sea level. The results (for one season) were good and all chemicals used, viz.: Phygon XL, Sr 406, Tribasic copper, Copper A, Tribasic alternated with Fermate, Fermate, Parzate alternated with Copper A, Zerlate, and Parzate, gave significant control. The first five named were the best, ranging from 8 to 4 times the yield of the control.

Strains; Varietal Resistance

BRAZIL:

State of São Paulo: We do not have information about strains of Phytophthora infestans in Brazil.

COLOMBIA:

Race "A" is widely disseminated through the Bogota plain and eastern Andean Cordillera. Biotype "D" is infrequent and of limited distribution. [Cf. Rojas, E. de and N. Estrada. 1953. El problema de las razas fisiologicas de Phytophthora infestans (Mont.) de Bary. Colombia Ministerio de Agricultura, Div. Investigacion Informacion Tec. 1: 1-78.]

PERU:

The physiological races of Phytophthora infestans, determined in Peru, according to the scale of Dr. Black, are the following: A, D, C [cf. Segura, Consuelo Bazán de. 1952. Razas fisiologicas de Phytophthora infestans en el Peru. Centro Nac. de Invest. y Exp. Agric., La Molina, Boletin 46]; I and J [cf. Black, W., et al. 1953. A proposal for an international nomenclature of races of Phytophthora infestans and of genes controlling immunity in Solanum demissum derivatives. Euphytica 2: 173-179].

The races, according to the International Scale will have the following numbers: A = 0, D = 1, C = 2, J = 3, I = 3, 4.

With regard to the work on resistant varieties of tomato, nothing has as yet been accomplished in Peru.

URUGUAY:

No studies have been done on strains of Phytophthora infestans.

VENEZUELA:

No information is available on strains, nor on varietal resistance. However, there is a native tomato that "seems" to stand up better than commercial varieties.

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CENTRAL AMERICA

First Report

COSTA RICA:

Tomato late blight was probably reported in Costa Rica at least 50 years ago; no actual date is known [to writer].

EL SALVADOR:

No record of first report; known that tomato late blight is present and apparently has been for many years.

GUATEMALA:

No published records of the occurrence of late blight in Guatemala.

HONDURAS:

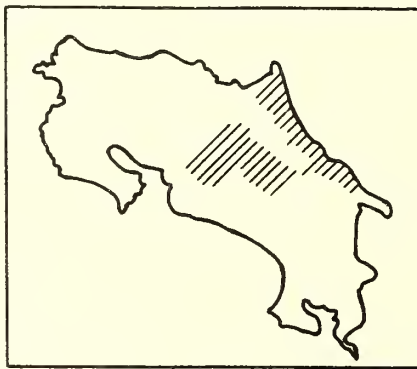
Phytophthora infestans was reported on tomato in 1952 [cf. Plant Disease Records at Zamorano, Honduras, 1950-1952. Ceiba 3, 2, p. 85-91. 1952], after it had been observed in 1949, 1950, and 1951 in Honduras. Believed to have been present for many years.

Distribution

BRITISH HONDURAS:

Phytophthora infestans probably does occur in British Honduras; tomatoes are grown on a comparatively small scale.

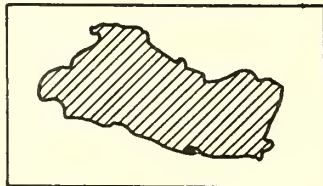
COSTA RICA:



Costa Rica
(Transverse Mercator proj.
94.7 miles to the inch)

Tomato late blight is well distributed in the Atlantic and Pacific watersheds of Costa Rica, with greater incidence in the more rainy Atlantic and Central Plateau areas. The Central Plateau regions of San Jose and Alajuela produce the best tomatoes and, due to drier atmospheric conditions and other factors, the incidence of Phytophthora infestans is also less severe.

EL SALVADOR:



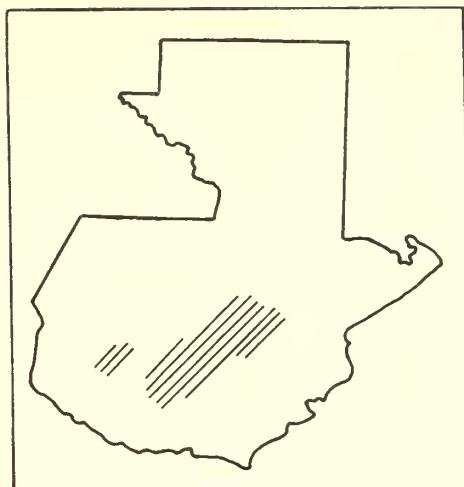
El Salvador
(Transverse Mercator proj.
94.7 miles to the inch)

Late blight appears to be present on tomatoes throughout the country; the country is small, densely populated, and intensely cultivated.

GUATEMALA:

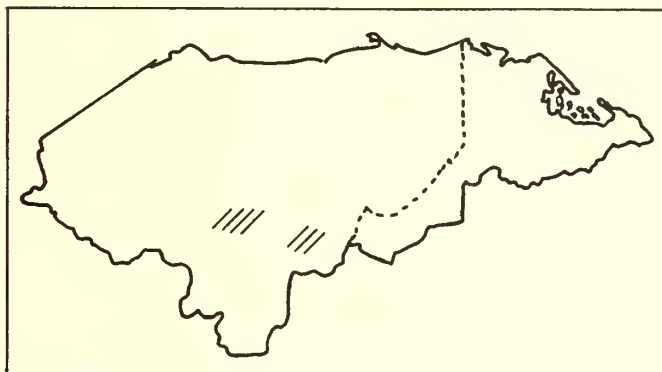
The disease has been found in the Departments of Guatemala, Sacatepeques, Chimaltenango, Quezaltenango, Progreso and Baja Verapaz.

In general, late blight in Guatemala is present at altitudes ranging from 3000 to 7500 feet provided there is abundant humidity. The disease occurs principally in the rainy season between May and October.



Guatemala
(Transverse Mercator proj.
94.7 miles to the inch)

HONDURAS:



Honduras
(Transverse Mercator proj.
94.7 miles to the inch)

The present distribution includes two locations, the region of Tegucigalpa and Danli in the highlands, 2,500 to 4,000 feet. However, we believe that the disease can be found in gardens nearby most highland towns, but not on the seacoast.

Spread; Environmental and Geographic Factors Involved;
Potential Danger Spots

COSTA RICA:

Phytophthora infestans spreads here mainly by wind-carried rain droplets and heavy mists. The prevailing moisture-laden easterly winds during most of the year favor the spread of late blight, but on the Carpintera mountain between Cartago and San Jose most of the moisture precipitates and the main part of the valley from Tres Rios to Palmares is considerably drier.

EL SALVADOR:

There is no reason to suspect that there are any effective major environmental or geographic barriers to the spread of the late blight organism.

Tomatoes are grown only in small patches; there have been no successful attempts at commercial production. Because of low production, tomatoes are a high-priced luxury.

Since tomatoes are grown in the rainy season, we would guess that rain and associated air currents serve as effective means of dissemination of this organism.

GUATEMALA:

The means of spread are probably wind and splashing rain water. It has been observed that tomatoes remain free of disease during severe years when they are planted in isolated places and where no tomatoes have been planted before. Fluctuating temperatures seem to favor the spread of late blight in Guatemala. Cool temperatures at night and warmer ones during the day, with a high relative humidity, are perhaps the main environmental factors contributing to disease development.

HONDURAS:

The disease seems to be limited to the highlands where there may be a drop in temperature of some 30 degrees between afternoon and early morning. It is a rainy-season disease, May to November. Dew is heavy in the highlands.

There are no reports from sea-level coastal towns which are pretty hot.

Damage

COSTA RICA:

In severe years there is a total loss from Phytophthora infestans, since the foliage and fruit are affected. In years of moderate infection from 25 to 40 percent of the crop may be lost. In most of our drier seasons (roughly December to May) losses probably do not amount to over 10 to 15 percent in the Alajuela-San Jose area.

EL SALVADOR:

We have no records on damage from late blight.

GUATEMALA:

It is difficult to evaluate the damage from late blight in Guatemala, as practically no tomatoes are grown in the country during the rainy season from May to October. The fear of having complete loss has caused growers to grow tomatoes only during the dry season.

HONDURAS:

In the highlands there appeared to be no difference over four years, 1949-1952, as to the years being severe blight years or years of moderate infection. In 1953 the period from May to November was very dry. There was no rainy season and most crops were lost to drought. I doubt if there was much Phytophthora that year.

Control Measures; Effectiveness of These Control Measures

COSTA RICA:

Control measures advocated include the organic fungicides and coppers. Dithane Z-78 (and tribasic copper sulfate to a lesser degree) has been used widely up to recent times, with varying degrees of success. Effectiveness cannot be reported accurately here because of the lack of experimental evidence. However, our feeling is that timely applications and better equipment or method of application of any of the better fungicides would increase their effectiveness here.

EL SALVADOR:

We have borrowed our recommendations for control of late blight from the States [U.S.]. Most fungicides used in the country are copper compounds.

GUATEMALA:

Control measures are not practiced in Guatemala for late blight. Tomato plantings are started in November when the blight danger is over. Occasionally attacks occur during November and December. However, no attempts are made during this time to control late blight. In only one case was a successful crop obtained during the rainy season by a commercial grower. He sprayed with Bordeaux mixture during the whole cycle of the crop.

HONDURAS:

Bordeaux mixture is the spray used as a control measure. Fungicides are not readily available commercially in Honduras, but materials for Bordeaux can be obtained. Little spraying is done in Honduras. Bordeaux is effective against tomato blights in Honduras.

Strains; Varietal Resistance

COSTA RICA:

No strains of Phytophthora infestans on tomato have been reported for Costa Rica. This fungus occurs on all standard U. S. commercial varieties grown here and on a local form of Lycopersicon cerasiforme. P. infestans developed promptly at Turrialba on Southland about 1949.

On potatoes P. infestans exists in all cool highland areas, especially in the rainy season. Race D is now more or less prevalent on three race D-susceptible varieties of potatoes that are being grown here at present.

EL SALVADOR:

We have no information on strains of Phytophthora infestans or resistant varieties. However, we suspect that the primitive method of growing tomatoes (i.e. in scattered small patches, saving own seed, no rotation, etc.) would lead to the natural selection of strains of both parasite and host.

GUATEMALA:

It is not known how many races of Phytophthora infestans are in Guatemala. Most of the commercial varieties grown in the country are introduced from the U. S. and are completely [susceptible] to late blight.

HONDURAS:

There is no accurate information on strains of Phytophthora in Honduras. Since, frequently, the intensity of foliage infection did not correspond with the intensity of fruit rotting, and vice versa, it may be that more than one strain is present. Some lines of Marglobe showed resistance to foliage blight.

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First Report

BERMUDA:

One record of late blight affecting tomatoes in Bermuda; made in January and February, 1934, on the fruit. Authenticity of this record remains in some doubt.

No records of Phytophthora spp. on tomato foliage in Bermuda.

BRITISH WEST INDIES:

Jamaica: The disease was first recorded here by Ashby in 1916.

Montserrat: First recorded in Montserrat (Leeward Islands of the Lesser Antilles) in 1939.

Trinidad: Phytophthora infestans has never been recorded in Trinidad.

CUBA:

Late blight was first reported in Cuba in 1945.

DOMINICAN REPUBLIC:

Late blight was reported in this country for the first time in 1927.

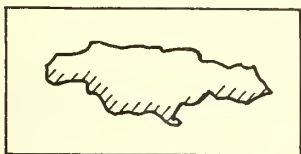
REPUBLIC OF HAITI:

Mildew of tomato was discovered in Haiti about 1945 in a leaf specimen from a plantation at sea level in environs of Port-au-Prince.

The disease existed, no doubt, previous to discovery as it has been known for a long time on potato. Tomatoes are frequently planted near potato fields at the higher altitudes.

Distribution

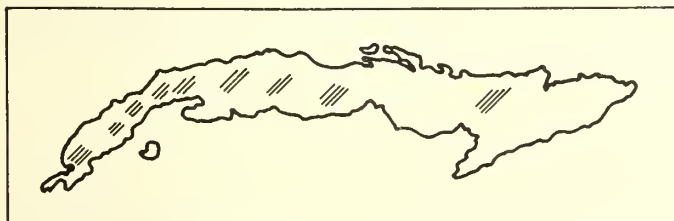
BRITISH WEST INDIES:



Jamaica
(Transverse Mercator Proj.
94.7 miles to the inch)

Jamaica: The disease is present wherever the crop is grown in Jamaica. Approximately 2,000 acres are planted with tomatoes yearly, mostly on the flat plains along the south coast, but small patches are to be found all over the Island.

CUBA:



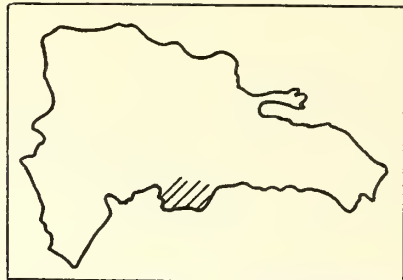
Cuba
(Chamberlin Trimetric Proj.
173.6 miles to the inch)

From 1946 onward the disease has spread through all the tomato zones of the country to such an extent that wherever tomatoes are grown Phytophthora infestans is present.

The disease has spread throughout the Island without regard to geographical barriers, such as mountains, etc.

DOMINICAN REPUBLIC:

The regions where late blight is most prevalent are: San Cristobal and Bani, district capitals ("comunes cabeceras") of the province of Trujillo and Trujillo Valdez, respectively. Areas free from the disease are the regions of San Jose de Ocoa, in the province of Trujillo Valdez; San Juan de la Maguana, district capital of the province of Benefactor, and Constanza in the province of La Vega.



Dominican Republic
(Transverse Mercator Proj.
94.7 miles to the inch)

REPUBLIC OF HAITI:



Haiti
(Transverse Mercator Proj.
94.7 miles to the inch)

At sea level and up to 400 or 500 meters of altitude, the disease is very rare. However, it is rather abundant in the cool and humid regions of Kenscoff, for example (about 20 kilometers from Port-au-Prince), at 1200 meters of altitude, about 20° C on the average in summer and 12° C in winter.

On the flat the tomato is planted in November-December when the temperature is in the neighborhood of 25° C on the average.

Spread; Environmental and Geographic Factors Involved;
Potential Danger Spots

BRITISH WEST INDIES:

Jamaica: It is generally worse during showery weather or when there are hot days and cold nights as occur in several sections of Jamaica during the winter months when tomatoes are chiefly grown.

CUBA:

As far as can be determined, the principal means of the spread of the disease is by wind although very possibly other factors are involved.

There are no environmental or geographic factors influencing the spread or limiting the distribution of the disease. As can be seen from a map of Cuba, the principal mountain ranges are close to either the north or south coasts and any land between these ranges and the nearest coastline is not planted to tomato but is planted with either rice or cane. At the same time cattle are raised on much of this particular land such as that in the Province of Pinar del Rio. This, of course, means that there are no barriers, such as mountains, to prevent the spread of the disease, the rest of the land being comparatively flat, thus facilitating the spread, the spores being carried by the wind.

DOMINICAN REPUBLIC:

The principal means of dissemination of late blight of tomato are;

- (a) Use of untreated, unselected seed.
- (b) Presence of the fungus in host plants such as potato and certain wild Solanaceae in the neighborhood of tomato plantings.

Geographical and environmental conditions influence the spread of late blight in regions of high humidity (the coastal portions of the country) with a temperature of 27-29° C. In the interior, where temperature and humidity are much lower than those cited, the disease has not been found on tomato. Plantings in the coastal localities of the provinces of Trujillo and

Trujillo Valdez are places of greatest danger of attack.

REPUBLIC OF HAITI:

It seems that the principal factors which favor the development of mildew of tomato in Haiti are a cool temperature and a humid period. Rain is the principal agent of spore distribution.

Damage

BRITISH WEST INDIES:

Jamaica: No survey has been made of the amount of damage or loss caused thereby.

CUBA:

Since the first report of the disease, and especially in the last two or three years, it would be impossible to separate years of severe blight from those of moderate infection; apparently the disease is progressively getting worse, so instead of noticing any less damage in any year which we could call a better year, the opposite is true. When control measures are not practiced, tomatoes are not harvested.

DOMINICAN REPUBLIC:

The greatest damage caused is estimated at 8 percent of total crop; the lowest estimate at 0.5 percent.

REPUBLIC OF HAITI:

Late blight has not been seen up to the present in the vast plantations of tomatoes in the mountains, where one encounters the propitious conditions for the development of Phytophthora. Not infrequently the small, extended, scattered and more or less isolated plantings can, likewise, avoid infection.

In the plain of Artibonite at sea level not a single case was observed during the last two years in the extensive tomato plantings.

Control Measures; Effectiveness of These Measures

BRITISH WEST INDIES:

Jamaica: Spraying with Bordeaux mixture, Perenox, or Dithane D-14, every 7 to 10 days, has given fairly good control.

CUBA:

Up until the past 5 years or so, Bordeaux mixture was the only means of control, which was none too effective. After Bordeaux mixture, growers switched to basic copper and recently to cuprous oxide, none of which is as effective as the dithiocarbamates.

The best control measures so far found have been the applications of Dithane, of Rohm & Haas, or Parzate, of DuPont. Both these products seem to hold the disease in check even after infection, whereas the copper compounds apparently do not do so. Very often late blight attacks the seedbeds, so within the past two years it has become the practice to spray at intervals of approximately 5 days from the time the plant reaches a height of 2 inches until harvest. This is especially true for low-lying districts where morning mists are prevalent; fields planted on higher grounds are sprayed or dusted at intervals of 7 to 10 days. The organic fungicides have been giving good results but, as in other countries, must be considered as preventatives. It can truthfully be said that if it were not for zineb-type fungicides, the tomato crop in Cuba would be practically non-existent.

DOMINICAN REPUBLIC:

Control measures practised for late blight of tomato, with good results, consist of the application of the fungicides Dithane Z-78, Manzate, and Zerlate.

REPUBLIC OF HAITI:

In general, we do not treat the plants against mildew. However, the applications of Bordeaux mixture, which constitute an ordinary preventive measure against diseases in general, appear certainly to hold Phytophthora infestans in check.

Strains; Varietal Resistance

BERMUDA:

No research work has been carried out on the strains of Phytophthora infestans in Bermuda.

BRITISH WEST INDIES:

Jamaica: There is no information at hand on the number of strains of Phytophthora infestans existing in Jamaica.

CUBA:

There must be at least two or perhaps three distinct strains of Phytophthora infestans in Cuba, since it has recently been noted that with temperature and weather conditions under which the old strain would not prosper, the disease seems to abate very little. Further, when late blight was first noted fairly good control could be effected with the coppers, something which is now not true.

DOMINICAN REPUBLIC:

Up to the present time, no work has been undertaken in the country in distinguishing different types of Phytophthora infestans.

REPUBLIC OF HAITI:

We have no data on the probable existence of different strains of fungi in Haiti. The varieties of tomatoes currently utilized in Haiti are "Marglobe" and "Oxheart", the seeds of which are imported each year from the U. S. As elsewhere, the position of the tomato with reference to problems posed up to now by Phytophthora infestans, does not appear at the moment to necessitate researches in Haiti concerning the strains of the microorganisms and varietal resistance of the hosts.

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NORTH AMERICA
(including U. S. possessions in other areas)

First Report

CANADA:

First definite report of late blight of tomato in Canada was made in an anonymous report in 1916. It was recorded as "injuring the foliage and fruit of tomato in Ontario, but" . . . "is the first record of its causing a damping-off of tomato plants."

However, as early as 1895 directions for spraying tomatoes (as well as potatoes) with Bordeaux mixture against "rot and blight" were published [Cf. Craig, John. 1895. Spraying for the prevention of fungous diseases. In Central Exp. Farm Agr. Bull. 23. p. 16].

MEXICO:

First record date unknown in Mexico.

UNITED STATES:

Found on tomatoes by H. W. Ravenel in September and October of 1859, in South Carolina (Cf. Farlow, W. G. 1876. Synopsis of the Peronosporae of the United States. Peronospora. Bull. Bussey Institution 1: 426-429).

Ravenel also collected Phytophthora infestans on tomato at Aiken, South Carolina, March 1876 (specimen in National Fungus Collections, Beltsville, Maryland).

It was reported again in 1890 as attacking leaves of tomato plants so as to cause considerable damage and appearing in virulent form upon green and even partly ripe fruit. (Cf. Thaxter, Roland. 1891. Report of the Mycologist. In Annual Report of the Connecticut Agricultural Experiment Station for 1890. p. 95.)

GUAM:

No specific information available for Guam.

PUERTO RICO:

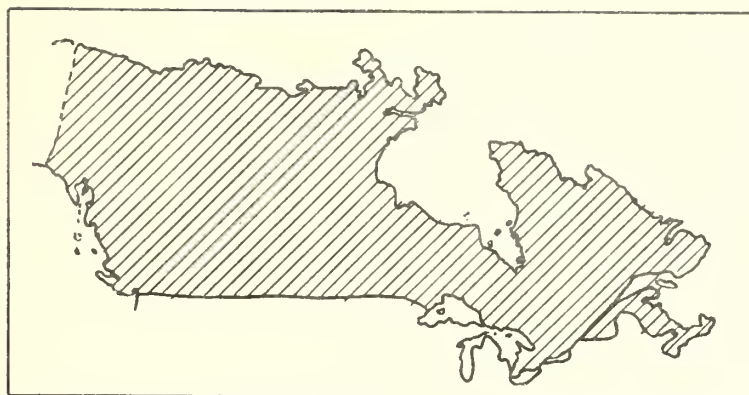
Late blight was first reported in Puerto Rican Experiment Station Bulletins by Henricksen, H. C. 1906. Vegetable growing in Porto Rico. Porto Rico Agric. Exp. Sta. (Mayaguez) Bull. 7 58 pp., illus.

TERRITORY OF HAWAII:

Late blight was first recorded for the Territory in 1918.

Distribution

CANADA:



Canada
(with the exception of northern islands
and peninsulas; approx. 900 miles to the
inch)

Tomato fruits affected by late blight have been received at Ottawa from every province in Canada, including Newfoundland.

In Table 1 are shown the reports of the occurrence of late blight on tomato as recorded in the Plant Disease Survey for the years 1922-1953. The disease is now known from every province in Canada.

In the 34 years since the Survey began, late blight has gradually extended its range until it may be found in all agricultural areas that are relatively contiguous except for an area in Alberta and Saskatchewan approximating closely the outline of the Palliser Triangle. These extensions have come during recurrent cycles of wet years.

Late blight was first recorded in Manitoba in 1927 (potato), in Alberta in 1943 (potato and tomato), and in Saskatchewan in 1946 (potato). The disease seems to have now established itself in Manitoba, but its hold on the British Columbia interior, Alberta, and Saskatchewan is tenuous.

The fact that the records of the occurrence of *Phytophthora infestans* on tomato follow so closely those on potato adds support to the view that only one organism is responsible for the disease on the two hosts. The larger number of reports of both diseases in recent years may be due in part to the greater number of observers. Undoubtedly, the use of the newer pesticides has greatly extended the life of the potato vines and increased the chances of the vines and tubers becoming infested. The use of southern-grown transplants in fields devoted to canning crops may have also had an effect.

There is some evidence that late blight became more destructive on tomato fruit beginning in 1940. If there was evidence of "potato" and "tomato" strains of *P. infestans* before that time, there is direct field evidence that potatoes are now infected by strains capable of causing great destruction to tomatoes.

Table 1. Reports from the Canadian Plant Disease Survey of late blight on tomato, 1922-1953.

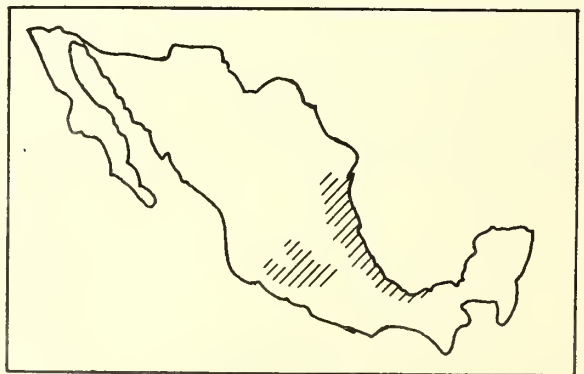
Year	British Columbia	Alberta	Saskatchewan	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	Prince Edward Island	Newfoundland	Remarks
1922							+			0	
1927							+			0	
1931							+			0	
1932									+	0	
1934	+								+	0	
1935						+				0	
1936							+		+	0	
1937	+									0	
1938									+	0	
1940	+				+		+			0	Severe in Ontario
1941	+				+	+	+		+	0	
1942					+	+				0	
1943		+		+	+	+	+	+	+	0	
1944				+	+	+	+		+	0	
1945				+	+	+	+	+	-	0	
1946					+	+	+		+	0	Severe in Ontario
1947	+				+	+	+	+	+	0	Severe in Ontario
1948	+			+	+	+	+	+	+	0	Severe in Ontario
1949					+			+	+		
1950	+			+	+	+	+	+	+		Severe in greenhouse crops in Ontario.
1951	+			+	+	+	+	+	+	+	
1952	+				+	+	+	+	+		
1953	+		+		+	+	+	+		+	Unpublished

+ = reported present.

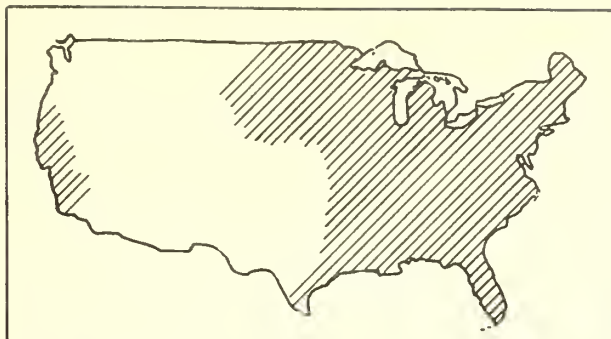
- = reported not present.

MEXICO:

The present known distribution of tomato late blight in Mexico has not been charted; it is known to exist along the coast of the Gulf of Mexico and the Bay of Campeche and in the southcentral part of the country.



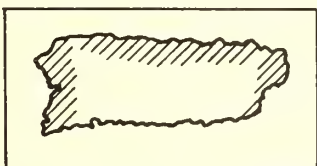
Mexico
(World Mercator Proj.
approx. 500 miles to the inch)



United States
(approx. 900 miles to the inch)

Tomato late blight is distributed in the New England States and can be found in certain sections of the Middle Atlantic, south central, and South Atlantic States. Occasionally it has been reported in some sections on the Pacific Coast. Recently it has been found in several mid-western and north central States (see also under Spread).

PUERTO RICO:

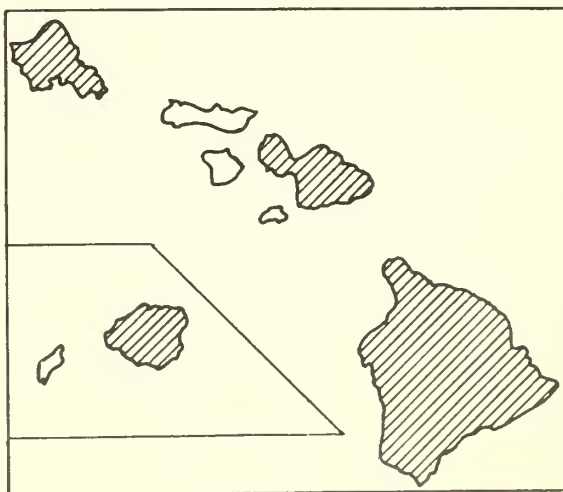


Puerto Rico
(approx. 137 miles to the inch)

Tomato late blight is endemic in Puerto Rico and occurs frequently in the mountainous areas and in the northern, western, and eastern coastal plains where rainfall is abundant.

TERRITORY OF HAWAII:

Late blight is known to occur on the four largest islands of the Hawaiian group; namely, Hawaii, Maui, Oahu, and Kauai.



Territory of Hawaii
(Mercator Proj.
434 miles to the inch)

Spread; Environmental and Geographic Factors Involved;
Potential Danger Spots

CANADA:

The disease is believed to be spread by wind-borne spores. The source of inoculum in Canada is probably potato cull piles although reports of infection from southern-grown transplants are known.

MEXICO:

Principal means of spread appear to be winds. The geographical contours of the country (high mountain ranges) which isolate numerous valleys appear to limit or at least influence tremendously its distribution.

Potential danger spots include the tomato-growing region near Ciudad Valles and El Mante. Because of the late blight problem and other foliage diseases, tomatoes are not cultivated to any great extent in the high valleys where late blight could be very severe.

UNITED STATES:

The most recent advance in the distribution of tomato late blight in the United States has occurred within the past few years. In 1950 it spread on tomatoes westward into Arkansas, Missouri, Iowa, and Nebraska and in 1951 continued its northwestward movement across the upper tier of north central States.

Environmental factors contributing to this spread include: the existence of potato dump piles near tomato fields; appearance of blight on volunteer potato plants; gradual spread of blight from field to field by airborne spores; and the transfer of infection from one part of the country to another on southern-grown transplants affected with blight. In 1950 the weather conditions were extremely favorable for the development of blight. In the affected areas, mostly in the eastern to midwestern portions of the country, a warm winter, followed by a cool spring and warm-wet early summer with a cool-wet midsummer, provided the ideal conditions for blight development. Blight spreads most rapidly during damp weather when temperatures do not go much above 70°F.

Neighboring blight-infected potato fields, blight-infected tomato transplants from the South, and infected potato cull piles are potential dangerous sources of tomato blight outbreaks.

PUERTO RICO:

The principal means of spread are wind, splashing rains, and run-off water. Also, low temperatures (16-20°C.) during the fall and winter months and abundant rainfall or water of condensation favor infection.

The topography of the land has some influence. In the mountainous areas the temperature is lower during the longer periods than in the coastal plains; therefore, the disease is spread over more months. On the south coast the relatively scanty rainfall per year (40 inches) and the dry winds are factors moderating the incidence and spread of the disease. However, under irrigation blight can be serious if the temperature and atmospheric humidity surrounding the tomato plants favor the development of the disease. In the Isabela district, under irrigation, late blight has been serious some years.

TERRITORY OF HAWAII:

Airborne spores are probably the chief means of spread from farm to farm within each of the islands, which are separated by distances ranging from 80 to 200 miles or so.

Infected volunteer plants growing the year round in the cooler, wet areas could serve as likely sources of spread, also.

The potential danger spots where a severe outbreak could occur are those in the higher elevation areas (1,500 to 3,000 feet). These areas are located on Maui and Hawaii.

Damage

MEXICO:

In severe blight years, we would estimate that damage is practically 100 percent; in years of moderate infection, probably 35 percent. These figures are not much more than guesses, but we hope to have more specific information in the future.

UNITED STATES:

Isolated epidemics, occurring in various parts of the tomato-growing areas of the country, have been reported, one as early as 1905 in Massachusetts. However, it was in 1946 that an unprecedented epidemic of late blight occurred in the eastern one-third of the country and caused an estimated \$40,000,000 loss in tomatoes. The South Atlantic Seaboard States experienced the heaviest attack with losses exceeding 50 percent. In 1950 tomato late blight was again of economic importance, attacking sizeable acreages and affecting the marketability of the crop. Estimated percent reduction in yield of these infected acreages varied from a trace to 95 percent. Severity and loss equalled or possibly exceeded that suffered from the destructive 1946 outbreak. In many cases untreated fields were completely destroyed. It was in this year that the disease moved westward and appeared in States where it had never been reported previously.

PUERTO RICO:

In severe blight years, complete loss of crops has been experienced. Estimates for losses during years of moderate infection are conflicting. A fair guess would be 10 to 30 percent.

TERRITORY OF HAWAII:

In severe years up to 30 percent loss has been observed, but previous workers have indicated more serious defoliation.

In years of moderate infection a 10 to 20 percent loss in yield has been observed.

Control Measures; Effectiveness of These Measures

CANADA:

Control measure suggested at the present time is a spray schedule involving an organic fungicide such as ziram or Manzate for the first applications during that part of the season when late blight does not threaten. Bordeaux mixture or a fixed copper is recommended for the control of blight. These measures are quite effective where applications are thorough and timely.

MEXICO:

Control measures recommended include the use of Bordeaux mixture and Copper A. No doubt in the Mante region other fixed coppers are used and recommended, but we know very little of this work and are not able to report on the effectiveness of such sprays.

UNITED STATES:

Good, standard cultural practices are recommended in the control of tomato late blight. These include the use of strong, disease-free tomato plants. These plants should not be crowded in planting for when planted too close together, the foliage dries out slowly after rains and heavy dews and affords excellent conditions for attack by late blight. Six feet should be allowed between rows with 3 feet between plants in the row.

Late blight can be controlled by spraying with Bordeaux mixture, usually at the rate of 8 pounds copper sulfate and 4 pounds of lime to 100 gallons of water. However, it is not recommended for tomato seedlings. Also, successful control can be obtained by spraying with a fixed copper fungicide. These fixed, or insoluble, copper compounds include copper oxychloride sulfate, basic copper sulfates, copper oxychloride, and copper oxide. They are generally proprietary compounds sold under trade names. Since these compounds do not contain lime, they

usually cause less injury to the plant and are recommended for seedbed spraying. As field sprays they are usually prepared on the basis of 2 pounds copper (calculated as metallic copper) to 100 gallons of water.

Good control has been obtained by spraying with disodium ethylene bisdithiocarbamate (Dithane D-14) used with zinc sulfate and lime, 2 qts.-1-1/2-100.

Another product, closely related to zinc sulfate reaction product of Dithane D-14, is zinc ethylene bisdithiocarbamate (Dithane Z-78, Parzate) which has given good control for late blight. The addition of zinc sulfate or lime is not required. Application should be made according to the directions of the manufacturer..

Spraying is preferred by most growers to dusting. However, fixed copper dusts are effective if properly applied. Sprays should be applied at intervals of 5 to 10 days, depending on the weather; for dusts the time lapse should be 7 days.

Since 1947 a Plant Disease Warning Service has been conducted by the Plant Disease Epidemics and Identification Section (formerly Mycology and Disease Survey Division) of the U. S. Department of Agriculture. Through timely and pertinent reports, based on material on the late blight situation sent in by collaborators in the States and Canada, farmers, growers, farm equipment and fungicide companies are warned of the presence or absence of disease in their areas. This permits the allocation of fungicides or equipment to sections most in need of spraying or dusting materials or machinery. It also warns the grower of the possibility of an impending attack and affords him the opportunity to prepare for it by the use of proper control measures. In the absence of late blight the grower need not spray, thus saving himself time, money, and energy.

PUERTO RICO:

Spraying with Bordeaux, Dithane D-14, Dithane Z-78, Parzate, Copper A compounds weekly in seedbeds and in the field has been recommended. These treatments often mean the difference between success or failure and have contributed to increased production in the tomato areas of Jayuya, Villalba, and Isabela.

Some growers report that the use of open-growing types is important and they also employ cultural practices that encourage aeration. This undoubtedly assists in obtaining good coverage with sprays.

TERRITORY OF HAWAII:

Formerly, fixed coppers were generally recommended and gave good late blight control, but more recent tests in 1952 showed Manzate to be superior to any other spray treatment. Consequently, many growers are using Manzate successfully. In 1952 spray test evaluations were made on late blight control. The descending order of control was Manzate, Tribasic, zineb, yellow cuprocide, ziram, and check.

Strains; Varietal Resistance

CANADA:

There is no evidence of "potato" and "tomato" strains of Phytophthora infestans in Canada although some isolates of the fungus are more aggressive on one host than on the other. We designate a common race 1 or 0 which attacks tomatoes and potatoes. A second, now labelled as tomato race 2, attacks selections of Lycopersicon esculentum var. cerasiforme that carry a single gene for resistance to Race 1. No commercial varieties of L. esculentum carry any tangible degree of resistance. Race 2 has been isolated from potatoes as well as tomatoes.

Race 1 or 0 is the most widespread, while Race 2 has been isolated from tomato fruits sent in from Essex and Carleton Counties, Ontario. It is not known to occur on tomatoes in Quebec and the Maritime Provinces. Only Race 1 has been isolated from material sent in from the western provinces.

As Race 2 seems limited in distribution, efforts have been concentrated on the incorporation of the available resistance to Race 1 into commercial tomatoes. So far, this resistance, of the hypersensitive, necrotic lesion type, has persisted to the second backcross to a commercial variety.

MEXICO:

No work has been done on strain study of the tomato late blight.

Varietal host resistance appears to exist in several wild tomato collections which have been made.

UNITED STATES

Study of the race problem in Phytophthora infestans in the United States has produced conflicting results.

After five seasons of inoculation experiments, Berg (1926) maintained that the potato and tomato strains of the fungus were biologically distinct. This appears to be the first record of biotypes in P. infestans. In 1933 Reddick's and Crosier's (see Bibliography) experiments and observations revealed no biological specialization among various isolates and they came to the opinion that there was only one biotype of P. infestans distributed throughout the U. S. and that this type was similar to the one found in Europe by Schick. They attributed Schick's (1932) results in Pomerania, where his experiments actually demonstrated the existence of three forms, to the introduction of Solanum demissum gene resistance which made variants more readily discernible, or to a new form arising from the germination of viable oospores. Later, Mills and Peterson (1949) showed that S. demissum was immune to all known races of P. infestans and that several genes were concerned in the resistance.

Mills (1940) has shown that the tomato strain is derived from potatoes and, although at first weakly parasitic on tomato, rapidly increases in virulence as it becomes adapted to life on tomato foliage by serial passage through this latter host. In cross inoculation studies Waggoner and Wallin (1952) demonstrated the existence of a tomato race and a potato race. These two races were equally pathogenic to potato but differed somewhat in development on tomato. The races were most often isolated from their specific hosts but each could also be isolated from the other host. Hyre (1949) suggested that there is only one tomato race of P. infestans and that the potato strain affects tomatoes in a minor way. Gallegly (1952) has presented experimental evidence to show that there are at least three races of the late blight organism pathogenic to tomato. Some wild hosts of tomato showed resistance to late blight, whereas no commercial varieties showed any resistance. In 1954 Gallegly and Marvel showed that there are two types of resistance to tomato race 1, the first controlled by a single dominant gene and the second derived from multiple genes.

It is hoped that further studies, both here and abroad, will eventually determine the existence and number of strains of P. infestans pathogenic on tomato.

Since the race picture is not entirely clarified and since many of our contributors mentioned the work done principally on potatoes in their countries on strains which were classified according to the International Designation for races of P. infestans, we include a chart of the International System of Designating Interrelationships of Genes and Races. This was primarily set up to classify the resistance of potato to races of P. infestans.

PUERTO RICO:

Race A has been identified.

TERRITORY OF HAWAII:

There has been very little work done here on strains of the late blight fungus although Hendrix reported in our [The Hawaii Agricultural Experiment Station] 1946-48 biennial report, p. 157: "Late blight resistance, for the strain of the organism occurring in Hawaii, has not been found in any tomato line tested. Plants of lines reported to have a promising degree of tolerance on the mainland have thus far been killed by late blight in tests... at Makawao, Maui. There have been no local varieties developed that are resistant to late blight."

INTERNATIONAL SYSTEM OF DESIGNATING INTERRELATIONSHIPS OF GENES AND RACES

GENOTYPE		RACES OF <i>P. infestans</i>															
Scotland		A	B ¹	H	J	D	G	E	B ²	C	I						
U.S.A.		A	D	C	-	B	-	-	BD	-	BC	-	-	-	-	-	
Holland		NI	N2	N5	-	N4	-	-	N7	-	N6	-	N8	-	N9	-	
International*		0	1	2	3	4	12	13	14	23	24	34	123	124	134	1234	
r	r	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	
R ₁	D	-	S	-	-	-	S	S	S	-	-	-	S	S	S	S	
R ₂	C	-	-	S	-	-	S	-	-	S	-	-	S	S	-	S	
R ₃	-	-	-	-	S	-	-	S	-	S	-	S	S	-	S	S	
R ₄	B	-	-	-	-	S	-	-	S	-	S	S	-	S	S	S	
R ₁ R ₂	CD	-	-	-	-	-	S	-	-	-	-	-	S	S	-	S	
R ₁ R ₃	-	-	-	-	-	-	-	S	-	-	-	-	S	-	S	S	
R ₁ R ₄	BD	-	-	-	-	-	-	-	S	-	-	-	-	S	-	S	
R ₂ R ₃	-	-	-	-	-	-	-	-	-	S	-	-	S	-	S	S	
R ₂ R ₄	BC	-	-	-	-	-	-	-	-	-	S	-	-	S	-	S	
R ₃ R ₄	-	-	-	-	-	-	-	-	-	-	-	S	-	-	S	S	
R ₁ R ₂ R ₃	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	S	
R ₁ R ₂ R ₄	BCD	-	-	-	-	-	-	-	-	-	-	-	-	S	-	S	
R ₁ R ₃ R ₄	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	S	
R ₂ R ₃ R ₄	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	
R ₁ R ₂ R ₃ R ₄	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	

* Races (2,3), (1,2,3) and (1,2,3,4) are hypothetical at present.

- = Resistant S = Susceptible

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SUMMARY IN ENGLISH AND INTERLINGUA

WHAT "INTERLINGUA" IS

For those who may not be familiar with "Interlingua", it is one of over 300 international languages which have been invented during the last century. The vocabulary is derived from Latin, Italian, Spanish, Portuguese, French, English, German, and Russian. It embodies all the word material that the languages of the Western World have typically in common. The troublesome intricacies of grammar have been discarded. There is only one verb form in each tense, and nouns, adjectives and verbs do not have to agree as is the case with more complex languages. Many will find the Interlingua vocabulary basically familiar to them because the scientific words generally are either derived from English roots when these are common to other languages or are taken from the Romance languages. Further information with regard to Interlingua can be obtained from Dr. Alexander Gode, Science Service, Division de Interlingua, 80 East Eleventh Street, New York 3, New York.

QUE ES INTERLINGUA?

Pro le information de personas non familiar con interlingua: Le vocabulario de iste plus recente inter alicun 300 linguas international proponite in le curso del passate seculo es derivate ab latino, italiano, espaniol, portugese, francese, anglese, germano, e russo. Illo incorpora omne le elementos linguistic que se trova typicamente in commun in le linguas del mundo occidental. Le enoiose complexitates grammatic ha essite eliminate. Interlingua possede un sol forma verbal in cata tempore, e substantivos, adjectivos, e verbos non exhibi ulle accordo grammatic (como il es le caso in le linguas plus complicate). Multe personas trovara que le vocabulario de interlingua es basicamente familiar a illes proque le formas de terminos scientific in ille idioma es derivate ab radices del linguas roman que etiam occurre in anglese.

Informationes additional in re interlingua es obtenibile ab Dr. Alexander Gode, Science Service, Division de Interlingua, 80 East Eleventh Street, New York 3, New York.

This paper presents a study of Phytophthora infestans (Mont.) D By. on Lycopersicon esculentum L., including records of first-reported occurrence of tomato late blight, its distribution, spread, the damage it causes, control measures applicable, and the existence and number of strains of the fungus. Data were obtained on a world-wide basis. Reports are given for 28 countries and territories in Europe, 29 in Africa, 11 in Asia, 9 in the Australasian area, 10 in South America, 5 in Central America, 7 in the Caribbean area, and all of North America.

First appearance records show that late blight was reported on tomato for the first time as early as 1843 and as recently as 1954. Recent first reports are concentrated in Africa.

Late blight of tomato is world-wide in its distribution.

Spread under natural conditions is governed usually by local environmental factors, including proximity to blighted potatoes, endemic spots, and infected nursery seedbeds. Weather conditions affecting the spread of late blight are wind, rain, high humidity, and temperatures not in excess of 70°F. Of particular interest is the recent appearance of late blight on tomato in areas where it had previously never been found, i. e. in parts of Africa heretofore free from the disease and some midwestern and north-central States of the United States.

The damage reported varies widely, and estimates of losses range from very slight to total destruction in years of severe epidemics.

Bordeaux mixture is a universally employed control measure. Other copper compounds are also used as well as the newer organic fungicides.

Races in Phytophthora infestans have not been investigated as yet in some areas. In several countries such studies are being made although many are concerned primarily with the strains of the fungus on potato. However, in several countries several biotypes on tomato have been determined.

Distribution maps are given in each continental section.

SUMMARIO IN INTERLINGUA

Iste articulo presenta un studio del fungo Phytophthora infestans (Mont.) D By. super Lycopersicon esculentum L., i. e. del morbo que es cognoscite como "peste tardive del tomate." Le studio coperi le tempore del prime reportos del peste, su distribution, su expansion, le damnos causate per illo, le mesuras usate in le lucha contra illo, e le existentia e le numero de stirpes del fungo in question. Le datos includite proveni ab omne partes del mundo: 28 paises e territorios de Europa, 29 de Africa, 11 de Asia, 9 del area australasian, 10 de Sud-America, 5 de America Central, 7 del area caribe, e Nord-America integre.

Le datos in re prime occurrentias indica que le pesta tardive de tomates esseva primo reportate jam in 1843 e ancora in 1954. Recente prime reportos es concentrate in Africa.

Le peste tardive del tomate ha un distribution mundial.

Sub conditiones natural su expansion depende normalmente de factores del ambiente local. Istos include le proximitate de patatas infestate, de locos endemic, e de inficite seminarios. Le factores meteorologic que es de importantia in le diffusion del peste tardive es vento, pluvia, alte humiditate, e temperaturas non excedente 21°C. Un observation de interesse special es le apparition in tempores recente de peste tardive del tomate in areas ubi illo habeva nunquam essite trovate previemente, i. e in certe areas de Africa e in alicun statos del medie-west e del nord central del Statos Unite.

Le damnos reportate varia grandemente. Estimationes del perditas suffrite coperi le integre spectro ab "levissime" a "destruction total" in annos de sever epidemias.

Un contra-mesura de uso universal es mixtura bordelese. Altere compositos de cupro es equalmente in uso e etiam le plus recente fungicidas organic.

Le racias de Phytophthora infestans es nondum investigate in alicun areas. In plure paises tal studios es in progresso ben que multes es primarimente concernite con le stirpes del fungo que occorre super patatas. Nonobstante, in plure paises plure biotypos occurrente super tomates ha essite identificate.

Mappas distributional es providite in le articulo pro cata section continental.

<u>Common Name</u>	<u>Host</u>	<u>Language</u>	<u>Reference</u>
Aardappelziekte (potato blight)	Potato	Dutch	Landbouwk. Tijdschr. 63: 77. 1951.
Blight of potato	Potato	English	Emp. Journ. Exp. Agric. 17: 238. 1949.
Eki-byo	Potato Tomato	Japanese	Nuttonson, M. Y. 1952. Ecological crop geography and field practices of the Ryukyu Islands, natural vege- tation of the Ryukyus, and agro- climatic analogues in the Northern Hemisphere. American Institute of Crop Ecology, Washington, D. C. p. 94.
Hielo (potato blight)	Potato	Spanish	Bol. Estac. Exp. Agric. No. 39, La Molina, Peru. 1950. Peru. Segura, C. Bazán de. Principal enfermedades de las plantas en el Peru. Bol. Estac. Exp. Agric. No. 51, La Molina, Peru. 1953.
Irish blight	Potato Tomato	English	Queensl. Agr. Jour. 60: 279. 1945.
Kartoffelskimmel	Potato	Danish	Statens Plantepatolog. Forsøg Maanedsoversigt over Plantesy- domme 321: 99-109. 1951.
Knollenfäule der Kartoffel	Potato	German	Pflanzenschutz 2: 13. 1950.
Krautfäule	Potato	German	Nachrichtenbl. Deutsch. Pflanzen- schutzd. (Braunschweig) 3: 104- 108. 1951.
Late blight of potato	Potato	English	Australian Pl. Dis. Rec. 2: 30. 1950.
Mancha Negra	Tomato	Spanish	Mex. Sec. de Agr. y Ganaderia Ofic. de Estud. Esp. Foll. Misc. 4: 154. 1951.
Mildiou de la pomme de terre	Potato	French	Parasitica 5: 89. 1949.
Mildiyö	Potato	Turkish	Bitki Koruma Bull. 1952. (4): 25.
Peronospora	Potato	Italian	Boll. della Staz. di Patol. Veg. 8: 262- 264. 1950 (1952).
Plamenjača	Potato	Croatian, Serbian	Cuturilo, S. 1952. Zastita Bilja 11: 27-41. Stojanovic, D., Panjanin, M. <u>et al.</u> Diseases and enemies of culti- vated plants 213 pp. 1951.

* Compiled by Bernard R. Lipscomb

<u>Common Name</u>	<u>Host</u>	<u>Language</u>	<u>Reference</u>
Plijesan	Potato Tomato	Croatian	Biljna Proizvodnja 6: 39, 42. 1953
Plížeň Bramborová	Potato Tomato	Czechoslovakian	Ochrana Rostlin 17: 21-34. 1941.
Potatisbladmögel	Potato	Swedish	Växtskyddsnotiser, Växtskyddsanst., Stockh. 1950: 19. 1950.
Rancha	Potato	Spanish	Segura, C. Bazán de. Principal enfermedades de las plantas en el Peru. Bol. Estac. Exp. Agric. No. 51, La Molina, Peru. 1953.
Requeima	Potato Tomato	Portugese	Biológico 17: 179-188. 1951. [Brazil].
Tomatenfruchtfäule	Tomato	German	Nachrichtenbl. Deutsch. Pflanzen- schutzd. (Braunschweig) 3: 104-108.
Tizon Tardio	Tomato	Spanish	Mex. Sec. de Agr. y Ganaderia Ofic. de Estud. Esp. Foll. Misc. 4: 154. 1951.
Zaraza Ziemniaczana	Potato	Polish	Zablocka, W. Grzyby Pasozytne. 79 pp. Warsaw.

HERBARIUM RECORDS

Phytophthora infestans (Mont.) de Bary on Lycopersicon esculentum L.

NATIONAL FUNGUS COLLECTIONS, BELTSVILLE, MARYLAND.

Mayaguez, P. R., May 15, ?1907; coll. H. C. Henricksen.

May 8, 1917; coll. J. A. Stevenson and H. E. Thomas.

Maricao, P. R., March 16, 1916; coll. H. H. Whetzel and Edgar W.
Olive.

Turrialba, Costa Rica, Jan. 1, 1947 and Jan. 10, 1949; coll. F. L.
Wellman.

Chimaltenango, Guatemala, Oct. 8, 1941; coll. A. S. Muller.

Königstein, Germany, Sept. 1910; W. Krieger, Fungi saxonici.

Reduit, Mauritius, Sept. 1923; coll. E. F. S. Shepherd.

Mauritius, June, 1925; coll. E. F. S. Shepherd.

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Mauritius -- Herb. I.M.I. 27,886.

British Cameroons -- Herb. I.M.I. 53,090.

ADDENDA

The following reports were received after this manuscript was prepared and ready for multilithing:

ETHIOPIA:

Late blight of tomato has not been seen in the Jimma area and to our knowledge nowhere in Ethiopia although it is reported in most of the adjacent countries and very likely will be found here sooner or later.

MOROCCO:

Important outbreaks of tomato late blight have occurred within 15 to 18 days following rains in January and February, 1955. Plants at every stage of growth, from seedlings to one- to four-month old transplants, were attacked even after the use of fungicides in a once or twice weekly spray schedule. Many farmers, however, did not spray at all in the rainy periods.

Also, in September, 1954, a late planting of tomato was partly wiped out by an outbreak of blight occurring after several foggy days without rain.

BELGIAN CONGO:

The laboratory at Mulungu has little information on the development of Phytophthora infestans on tomato.

The first record of occurrence dates from 1951 at Kivu where the disease is widespread.

One of the greatest difficulties has been in the control of the fungus. Many of the varieties sent to us as immune to the disease have not proven to be resistant under our local conditions. Copper fungicides have little effect in controlling the disease. Frequent application of derivatives of dithiocarbamic acid, particularly Zerlate and Manzate, appears to be much more efficacious. Treatment which planters are advised to follow at the present time is the alternate use of Zerlate or Manzate and oleo-copper.

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	First Report	Distri- bution	Spread	Damage	Control	Strains
EUROPE:						
Austria	4	--	--	--	--	--
Balearic Islands (with Spain)	5	10	--	--	--	--
Belgium	4	--	--	--	--	--
Canary Islands (with Spain)	5	10	11	--	--	--
Cyprus	4	6	11	--	13	15
Denmark	4	6	11	12	13	15
England	4	6	11	12	14	15
Estonia (Estonian S.S.R.)	4	--	--	--	--	--
Finland	4	7	11	12	14	15
France	4	--	--	--	--	--
Germany	4	7	11	12	14	15
Greece	4	--	--	--	--	--
Guernsey (Isle of)	--	7	--	--	--	--
Hungary	4	--	--	--	--	--
Ireland: See under Northern Ireland or Republic of Ireland.						
Italy	4	8	11	12, 13	14	15
Jersey (Isle of)	--	--	11	--	14	15
Malta	--	--	11	13	14	15
Netherlands	5	8	11	13	14	15
Northern Ireland	5	8	11	13	14	15
Norway	5	9	12	13	14	16
Poland	5	--	--	--	--	--
Republic of Ireland	5	9	12	13	14	16
Romania	5	--	--	--	--	--
Sardinia (with Italy)	4	--	--	--	--	--
Scotland	5	9	12	13	14	16
Spain	5	10	--	13	--	--
Sweden	--	--	12	--	14	--
Switzerland	5	10	12	13	14	16
U. S. S. R.	5	--	--	--	--	--
Yugoslavia	5	10	12	13	15	16
Bibliography: 16-19						!
AFRICA:						
Algeria	20	--	25	26	27	--
Angola	20	--	--	--	--	--
Belgian Congo (see also Addenda, p. 79)	20	--	--	--	--	--
British Cameroons	20	22	25	--	--	--
Egypt	20	22	25	26	27	28
Ethiopia (see Addenda, p. 79).						
French Somaliland	20	--	--	--	--	--
French West Africa	20	--	--	--	--	--
Gold Coast	20	--	--	--	--	--
Kenya	20	22	25	26	27	29
Liberia	20	--	--	--	--	--
Libya	20	23	25	26	27	29
Madagascar	20	--	--	--	--	--
Mauritius	20	23	25	26	28	29
Moçambique	20	23	25	27	28	29
Morocco (see also Addenda, p. 79)	21	24	25	27	28	29
Nigeria	21	--	--	--	--	--

	First Report	Distri- bution	Spread	Damage	Control	Strains
--	-----------------	-------------------	--------	--------	---------	---------

CENTRAL AMERICA:

British Honduras	--	54	--	--	--	--
Costa Rica	54	54	56	56	57	57
El Salvador	54	54	56	56	57	57
Guatemala	54	55	56	56	57	57
Honduras	54	55	56	56	57	57
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BERMUDA; WEST INDIES; CARIBBEAN REGION:

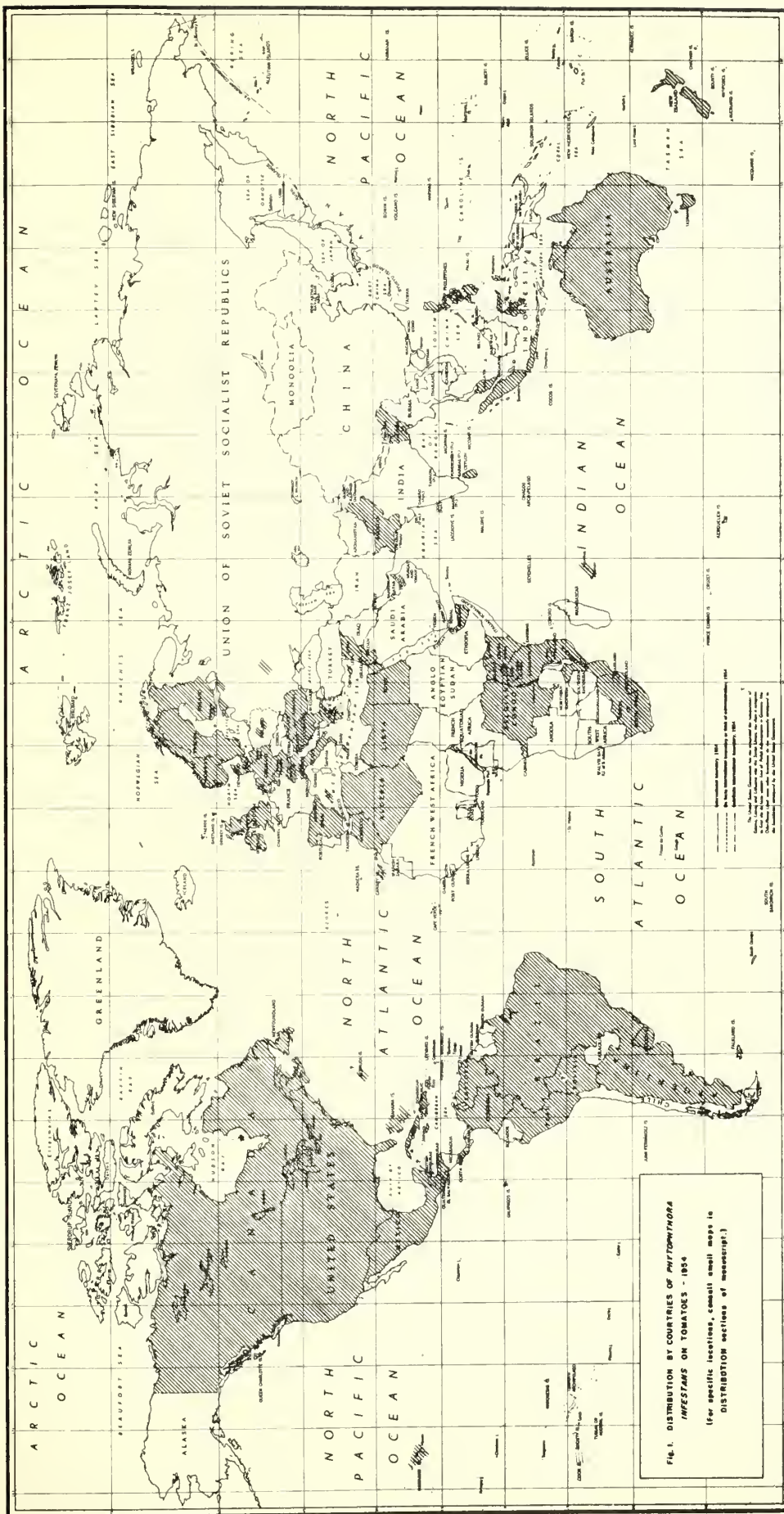
Bermuda	59	--	--	--	--	62
British West Indies						
Jamaica	59	59	60	61	61	62
Montserrat	59	--	--	--	--	--
Trinidad	59	--	--	--	--	--
Cuba	59	59	60	61	61	62
Dominican Republic	59	60	60, 61	61	61	62
Republic of Haiti	59	60	61	61	62	62
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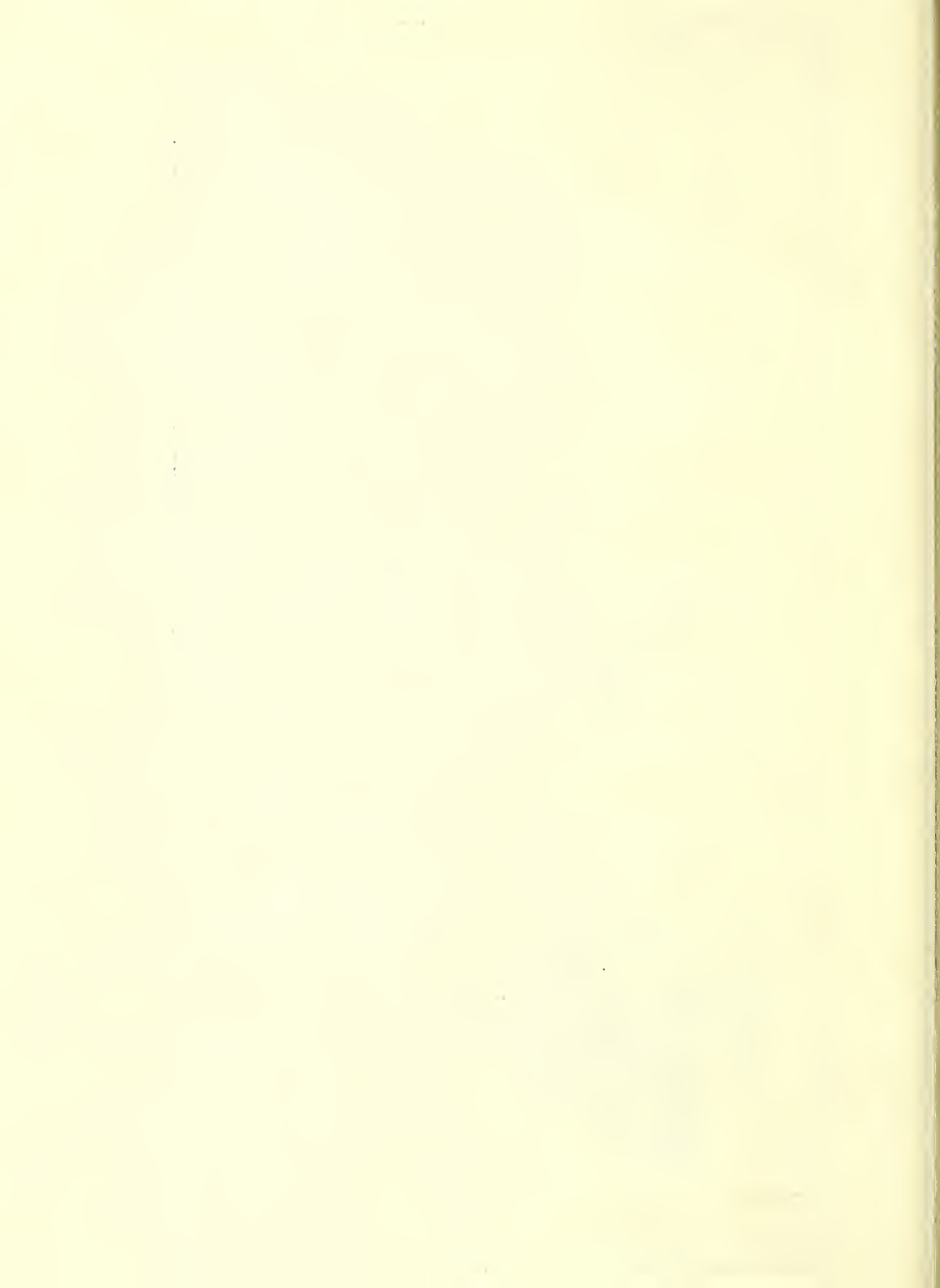
NORTH AMERICA (including U. S. possessions in other areas)

Canada	64	65, 66	68		69	70
Mexico	64	66	68	69	69	70, 71
United States	64	67	68	69	69, 70	71
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Territory of Hawaii	64	67	68	69	70	71
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PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION, HORTICULTURAL
CROPS RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE, UNITED STATES
DEPARTMENT OF AGRICULTURE, PLANT INDUSTRY STATION, BELTSVILLE, MARYLAND







THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS
and

IDENTIFICATION SECTION

AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

CHECK LIST OF THE DISEASES OF GRASSES
AND CEREALS IN ALASKA¹

Supplement 232

May 30, 1955



The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops Research Branch

Plant Industry Station, Beltsville, Maryland

CHECK LIST OF THE DISEASES OF GRASSES
AND CEREALS IN ALASKA¹

Roderick Sprague²

Plant Disease Reporter
Supplement 232

May 30, 1955

In the three years since a check list of the diseases of Gramineae for all western states and the territory of Alaska was issued³ the number of citations (host x fungi) for Alaska has increased from 49 to 311. Since it will be several years before a general revision of the list will be needed it seems desirable to separately issue one for Alaska because of the present inadequacy of that part of our list. The increase by over sixfold in Alaskan citations resulted from issuance of Cash's detailed check list⁴ of all hosts including Gramineae for the whole territory plus a series of articles by the writer on fungi collected in 1952 in the region.⁵

In the list which follows only parasitic fungi and some associated forms are included. Some early invaders of necrotic tissue which may be encountered such as Hendersonia crastophila Sacc. are included. Some of the saprophytic ascomycetes are excluded. The well known Mycosphaerella tassiana, for instance, is now generally recognized as only the ascigerous stage of a saprophytic mold. That is, the organism which we learned as M. tulasnei is part of the life cycle of a common saprophytic species of Cladosporium. A number of other similar forms however are included because of their uncertain parasitic nature. For the sake of completeness they are added here for the time being at least. In Alaska ascigerous forms are favored, sometimes to the exclusion of the conidial stages. Therefore any perithecial form may be suspect unless its saprophytic nature is well known.

¹ Scientific Paper no. 1395, Washington Agricultural Experiment Stations, Pullman. Project No. 449.

² Plant Pathologist, State College of Washington, Tree Fruit Experiment Station, Wenatchee, Washington.

³ Sprague, R., and Fischer, G. W. 1952. Check list of the diseases of grasses and cereals in the Western United States and Alaska. Washington Agr. Exp. Sta. Circ. 194.

⁴ Cash, Edith K. 1953. A check list of Alaskan fungi. U. S. Department of Agriculture Plant Disease Repr. Suppl. 219.

⁵ Sprague, R. 1954, 1955. Some leafspot fungi on western Gramineae--VII. Mycologia 46: 76-88. 1954. Ibid--VIII. Mycologia 47: in press.

- AGROPYRON LATIGLUME (Scribn. & Sm.) Rydb.
Ascochyta sorghi Sacc., Mile 245 on Richardson Highway.
Erysiphe graminis Mérat, Copper Center.
Scolecotrichum graminis Fckl., Richardson Highway; Muir's Camp⁶; Goose Cove⁶.
Stagonospora simplicior Sacc. & Berl., near Russell Is.⁶ (Cooper Sta. 26).
- AGROPYRON MICHNOI Roshev
Heterosporium phlei Gregory, Matanuska.
Ovularia pusilla (Ung.) Sacc. & D. Sacc., Matanuska.
- AGROPYRON REPENS (L.) Beauv.
Ovularia pusilla (Ung.) Sacc. & D. Sacc., Sebree Is.⁶
Scolecotrichum graminis Fckl., Sebree Is.; Muir's Camp.
- AGROPYRON SERICEUM Hitchc.
Erysiphe graminis Mérat, Fairbanks.
Scolecotrichum graminis Fckl., Fairbanks.
- AGROPYRON SPICATUM (Pursh) Scribn. & Sm.
Ascochyta sorghi Sacc., Mile 15 s. of Circle.
- AGROPYRON SUBSECUNDUM (Lk.) Hitchc.
Helminthosporium tritici-repentis Died.; Windfall Lake (Tongass Natl. Forest).
Puccinia rubigo-vera (DC.) Wint., Sandy Cove⁶.
Rhynchosporium orthosporum Caldwell, Sandy Cove; Yankee Basin (Tongass Natl. Forest).
R. secalis (Oud.) J. J. Davis, Yankee Basin near Mendenhall Glacier.
Septogloeum oxysporum Sacc., Bomm. & Rouss., Eagle River; Sandy Cove.
- AGROPYRON TRACHYCAULUM (Lk.) Malte
Acremoniella sp., Tlingit Point⁶.
Claviceps purpurea (Fr.) Tul., near Russell Is.
Heterosporium phlei Gregory, Kenai.
Ophiobolus graminis Sacc., Sandy Cove.
Ovularia pusilla (Ung.) Sacc. & D. Sacc., Homer.
Rhynchosporium secalis (Oud.) J. J. Davis, Homer.
Scolecotrichum graminis Fckl., Beartrack Cove⁶; Fairbanks; Homer; Goose Cove;
 Matanuska; Muir's Camp; Sandy Cove.
Selenophoma donacis var. *stomatícola* (Bauml.) Sprague & A. G. Johnson, Homer.
Stagonospora simplicior Berl. & Sacc., near Russell Is.
Urocystis agropyri (Preuss) Schroeter, Homer.
- AGROSTIS AEQUIVALVIS (Trin.) Trin.
Helminthosporium stenacrum Drechsl., Herbert River Valley.
Mastigosporium rubricosum (Dearn. & Barth.) Nannf., Auk Village.
Ovularia pusilla (Ung.) Sacc. & D. Sacc., Herbert River Valley.
Periconia sp., Bartlett Cove⁶.
Septogloeum oxysporum Sacc., Bomm. & Rouss., Herbert River Valley.
- AGROSTIS BOREALIS Hartm.
Mastigosporium rubricosum (Dearn. & Barth.) Nannf., Mt. Gastineau.
Pyrenochaeta terrestris (Hans.) Gorenz., Walker & Larson, in raw soil near
 Mendenhall Glacier.
Septoria avenae Frank, Mt. Gastineau.
- AGROSTIS EXARATA Trin.
Claviceps purpurea (Fr.) Tul., Craig.
Darluca filum (Biv.) Cast., on rust. Anchorage Cove⁶.
Erysiphe graminis Mérat, Sitka; Mendenhall River Valley.
Mastigosporium rubricosum (Dearn. & Barth.) Nannf., Mendenhall River Valley;
 Yankee Basin
Ophiobolus graminis Sacc., Mendenhall River Valley.
Ovularia pusilla (Ung.) Sacc. & D. Sacc., Herbert River Valley; Eagle River; s. f.
 Eagle River; Sandy Cove.

⁶In Glacier Bay National Monument. See footnote 5 above.

- Puccinia graminis* Pers., Anchorage Cove.
Rhynchosporium orthosporum Caldwell, Mendenhall Glacier area.
Septoria avenae Frank, s. f. Eagle River; Beartrack Cove.
S. calamagrostidis (Lib.) Sacc., Beartrack Cove; Sitka.
- AGROSTIS SCABRA** Var. **GEMINATA** (Trin.) Swallen.
Ascochyta sorghi Sac., Red Mountain (Glacier Bay).
Mycosphaerella ignobilis (Auers.) Maire & Werner, (probably saprophytic). Nagai.
Rhizoctonia solani Kuehn, s. f. Eagle River.
Septoria calamagrostidis (Lib.) Sacc., Yes Bay; Sitka.
Typhula sp., Red Mountain⁷.
- AGROSTIS STOLONIFERA** L.
Mastigospodium rubricosum (Dearn. & Barth.) Nannf., Herbert River Valley.
- AGROSTIS** sp.
Helminthosporium erythrospilum Drechs., Ketchikan.
Puccinia graminis Pers., Cordova.
Sphaerella californica Cke. & Hark; probably saprophytic). Yes Bay.
- ALOPECURUS AEQUALIS** Sobol.
Scolecotrichum graminis Fckl., Fairbanks.
- ALOPECURUS ALPINUS** J. E. Smith.
Ovularia pusilla (Ung.) Sacc. & D. Sacc., Homer.
- ARCTAGROSTIS LATIFOLIA** (R. Br.) Griseb.
Apiospora parallela (Karst.) Sacc., (probably saprophytic). Kotzebue.
Claviceps purpurea (Fr.) Tul., Berg; Kenai.
Darluca filum (Biv.) Cast. on rust. Mt. McKinley Natl. Park.
Heterosporium phlei Gregory, Nome.
Mycosphaerella recutita (Fr.) Johans., (probably saprophytic). Icy Reef.
Ovularia pusilla (Ung.) Sacc. & D. Sacc., St. Mathews Is.
Puccinia pygmaea Eriks., Nome; Glenn Highway.
Scolecotrichum graminis Fckl., Homer.
Selenophoma everhartii (Sacc. & Syd.) Sprague & A. G. Johnson, St. Mathews Is.
Ustilago striiformis (West.) Niessl, Unalakleet.
- ARCTAGROSTIS LATIFOLIA** var. **ARUNDINACEA** (Trin.) Griseb.
Hendersonia crastophila Sacc., Naknek.
Puccinia pygmaea Eriks., Nome; Alaska Highway.
- ARCTOPHILA FULVA** (Trin.) Rupr. (Colpodium).
Claviceps purpurea (Fr.) Tul., Circle.
Mycosphaerella pusilla (Auers.) Johans., Preobraschenie Is.
Pleospora macrospora Schroet., (probably saprophytic). Preobraschenie Is.;
 Camden Bay.
- AVENA SATIVA** L.
Helminthosporium avenae Eidam, Sitka.
Ustilago avenae (Pers.) Rostr., Fairbanks; Sitka.
U. hordei (Pers.) Lagerh., Palmer; Fairbanks; Matanuska.
- BECKMANNIA SYZIGACHNE** (Steud.) Fern.
Erysiphe graminis Mérat, Fairbanks.
- BROMUS ALEUTENSIS** Trin.
Fusarium nivale (Fr.) Ces., Unalaska Is.
Hendersonia culmicola Sacc., Unalaska Is.
- BROMUS ARCTICUS** ⁸
Puccinia coronata Corda, Anchorage.

⁷Loc. cit., footnote 5

⁸This host is not listed in either Anderson's Flora of Alaska (Iowa State College Jour. Sci.) or Hitchcock's Manual of the grasses of the United States. U. S. D. A. Misc. Publ. 200.

BROMUS CILIATUS L.*Puccinia coronata* Corda, Anchorage.*Rhynchosporium secalis* (Oud.) J. J. Davis, Homer.**BROMUS INERMIS Leyss***Heterosporium phlei* Gregory, Anchorage.*Ovularia pusilla* (Ung.) Sacc. & D. Sacc., Anchorage.*Mycosphaerella recutita* (Fr.) Johans., (probably saprophytic). Near Fairbanks.*Puccinia coronata* Corda, Anchorage.*Selenophoma bromigena* (Sacc.) Sprague & A. G. Johnson, Fairbanks; College.**BROMUS PUMPELLIANUS Scribn.***Stagonospora bromi* A. L. Sm. & Ramsb., College.**BROMUS SECALINUS L.***Mycosphaerella longissima* (Fckl.) Lind, (probably saprophytic). Sitka.**BROMUS SITCHENSIS Trin.***Erysiphe graminis* Méral, Hoonah.*Septoria jaculella* Sprague, Hoonah.**BROMUS sp. (and hybrids)***Heterosporium phlei* Gregory, Matanuska.**CALAMAGROSTIS CANADENSIS var. SCABRA (Presl) Hitchc.***Acremonia* sp., Herbert River Valley.*Claviceps purpurea* (Fr.) Tul., Haines; Sitka.*Coniothyrium psammae* Oud., Unalaska Is.*Darluca filum* (Biv.) Cast., Unalaska Is.*Fusarium nivale* (Fr.) Ces., Juneau; Mendenhall River Valley.*Hadrotrichum linearis* Pk., Sitka.*Hendersonia crastophila* Sacc., Seward; Unalaska Is.*H. culmicola* var. *minor* Sacc., Seward; Wasilla.*Heterosporium phlei* Gregory, Unalakleet; Wasilla.*Mastigosporium rubricosum* (Dearn. & Barth.) Nannf., Beartrack Cove;

Anchorage; Mt. McKinley Natl. Park; Red Mountain, Unalakleet; Wasilla.

Mycelia sterilia, on roots, in raw soil. Near Mendenhall Glacier.*Ovularia pusilla* (Ung.) Sacc. & D. Sacc., Yankee Basin trail.*Phyllachora graminis* (Fr.) Fckl., Sitka.*Puccinia coronata* Corda, College; Tlingit Point; Unalaska Is.; Wiseman.*Rhynchosporium orthosporum* Caldwell, Auk Lake; Herbert River Valley;

Mendenhall River Valley; Montana Creek (near Mendenhall area); Yankee Basin; Mt. Gastineau.

Sclerotium rhizodes Auers., Homer.*Scolecotrichum graminis* Fckl., Auk Village; Herbert River Valley; near Herbert Glacier; Mendenhall Glacier area.*Selenophoma everhartii* (Sacc. & Syd.) Sprague & A. G. Johnson, Mt. Gastineau.*Septogloeum oxysporum* Sacc., Bomm. & Rouss., Mt. McKinley; Unalakleet.*Septoria arctica* Berk. & Curt., Sitka.*S. avenae* Frank, Herbert River Valley.*Ustilago calamagrostidis* (Fckl.) Clinton; Unalakleet.*U. striiformis* (West.) Niessl, Homer; Yankee Basin; Herbert River Valley; Mt. Gastineau.**CALAMAGROSTIS NUTKAENSIS (Presl) Steud.***Claviceps purpurea* (Fr.) Tul., Ketchikan; Sitka.*Colletotrichum graminicola* (Ces.) G. W. Wils., Tatalina; north of Fairbanks.*Mastigosporium rubricosum* (Dearn. & Barth.) Nannf., Thum Bay.*Puccinia pygmaea* Eriks., Sitka.*Septoria arctica* Berk. & Curt., Sitka.**CALAMAGROSTIS PURPURASCENS R. Br.***Colletotrichum graminicola* (Ces.) G. W. Wils., Mt. McKinley Natl. Park.**CINNA LATIFOLIA (Trevir) Griseb.***Hendersonia crastophila* Sacc., Tlingit Point⁹

Undetermined leafspot, Tlingit Point.

⁹Loc. cit. footnote 5.

DACTYLIS GLOMERATA L.

Claviceps purpurea (Fr.) Tul., Sitka.

DESCHAMPSIA ATROPURPUREA (Wahl.) Scheele

Bends, cause undet, Mendenhall River Valley.

Mycosphaerella deschampsiae Sprague, Mendenhall River Valley;
Red Mountain.

Ovularia pusilla (Ung.) Sacc. & D. Sacc., Mendenhall River Valley;
Red Mountain; Yankee Basin.

Puccinia poae-sudeticae (West.) Jørdst. f. *airae* (Lagerh.)
Eagle River.

Stagonospora graminum Sacc. & Scalia, Illiuliuk.

DESCHAMPSIA BERINGENSIS Hult.

Curvularia geniculata (Tracy & Earle) Boed., St. Mathews Is.

Selenophoma everhartii (Sacc. & Syd.) Sprague & A. G. Johnson, St. Mathews Is.

Stagonospora vexatula Sacc., St. Mathews Is.

DESCHAMPSIA CAESPITOSA (L.) Beauv.

Colletotrichum graminicola (Ces.) G. W. Wils., Near Juneau airport.

Ophiobolus graminis Sacc., Old lake bed near Mendenhall Glacier.

Stagonospora vexatula Sacc., Yankee Basin.

Tilletia cerebrina Ell. & Ev., Kodiak Is.

DUPONTIA FISCHERI R. Br.

Septoria arctica Berk. & Curt. Bering Sea.

DUPONTIA FISCHERI R. Br. ssp. PSILOSANTHA (Rupr.) Hult.

Selenophoma everhartii (Sacc. & Syd.) Sprague & A. G. Johnson, St. Mathews Is.

ELYMUS INNOVATUS Beal

Helminthosporium tritici-repentis Died., Mt. McKinley Natl. Park.

ELYMUS JUNCEUS Fisch.

Erysiphe graminis Mérat, Matanuska.

Heterosporium phlei Gregory, Matanuska.

Stagonospora arenaria Sacc., Matanuska.

ELYMUS MOLLIS Trin.

Claviceps purpurea (Fr.) Tul., Chatham; Haines; Homer; Admiralty Is.; Kenai;
Ivanof Bay; Unalakleet; Valdez; Sitka; Bartlett Cove; Beartrack Cove; Seabee Is.;
Strawberry Is.; Common along the beaches.

Colletotrichum graminicola (Ces.) G. W. Wils., Beartrack Cove.

Puccinia rubigo-vera (DC.) Wint., Sitka.

Scolecotrichum graminis Fckl., Auk Village Recreation Area.

Septoria agropyria Lobik, Auk Village Recreation Area.

S. pacifica Sprague, Beartrack Cove.

Stagonospora arenaria Sacc., Seward.

ELYMUS VIRESCENS Piper

Puccinia rubigo-vera (DC.) Wint., Sitka.

FESTUCA ALTAICA Trin.

Heterosporium phlei Gregory, Homer.

Phaeoseptoria festucae Sprague, Eagle Summit.

Puccinia festucae (DC.) Plowr., Homer.

FESTUCA ELATIOR L.

Phleospora idahoensis Sprague (*Phoma* sp.), material collected in s. e.

Alaska by C. L. Lefebvre.

FESTUCA OVINA var. BRACHYPHYLLA (Schult.) Piper

Fusarium acuminatum Ell. & Ev., Mendenhall Glacier area.

F. nivale (Fr.) Ces., Mendenhall River Valley.

Hendersonia culmicola Sacc., Mt. Gastineau.

Ophiobolus graminis Sacc., Near Mendenhall Glacier.

Puccinia crandallii Pam. & Hume, Mt. Gastineau; Mendenhall River Valley.

Pythium debaryanum Hesse, raw soil near Mendenhall Glacier.

Septoria tenella Cooke & Ell., s. f. Eagle River.

Spermospora subulata (Sprague) Sprague, Mendenhall Glacier area.

FESTUCA RUBRA L.

- Claviceps purpurea* (Fr.) Tul., Unalakleet.
- Fusarium avenaceum* (Fr.) Sacc., Mendenhall River Valley.
- Ovularia pusilla* (Ung.) Sacc. & D. Sacc., Homer; Herbert River Valley; Sandy Cove; Bartlett Cove.
- Phleospora idahoensis* Sprague (*Phoma* sp.), material collected in s. e. Alaska by C. L. Lefbvre; Mendenhall River Valley.
- Septoria tenella* Cooke & Ell., Sandy Cove.
- Spermospora subulata* (Sprague) Sprague, Beartrack Cove.
- Vermicularia* sp., Bartlett Cove.

FESTUCA RUBRA var. LANUGINOSA Mert. & Koch

- Heterosporium phlei* Gregory, Kenai.
- Ovularia pusilla* (Ung.) Sacc. & D. Sacc., Homer.
- Puccinia cockerelliana* Bethel, Kenai.

FESTUCA RUBRA var. PROLIFERA Piper

- Septoria tenella* Cooke & Ell., Tlingit Point.

GLYCERIA BOREALIS (Nash) Batch.

- Fusarium nivale* (Fr.) Ces., Juneau.
- Hendersonia crastophila* Sacc., Juneau.

GLYCERIA PAUCIFLORA Presl

- Claviceps purpurea* (Fr.) Tul., Ketchikan.
- Ovularia pusilla* (Ung.) Sacc. & D. Sacc., Eagle River; Herbert River Valley; Yankee Basin.
- Chlorotic leaf ribboning, possibly frost induced, on trail to Windfall Lake.

HIEROCHLOE ALPINA (Schwartz) Roem.

- Hendersonia crastophila* Sacc., Mt. Gastineau.
- Pleospora trichostoma* (Fr.) Ces. & de Not., Mt. Gastineau; Red Mountain; Kotzebue.

HIEROCHLOE PAUCIFLORA R. Br.

- Pleospora karstenii* Berl. & Vogl., Camden.

HORDEUM BRACHYANTHERUM Nevski

- Ascochyta sorghi* Sacc., Funter.
- Claviceps purpurea* (Fr.) Tul., Sitka; Kenai.
- Erysiphe graminis* Mérat, Hoonah; Valdez.
- Fusarium avenaceum* (Fr.) Sacc., Bartlett Cove.
- F. acuminatum* Ell. & Ev., Bartlett Cove.
- F. equiseti* Corda Sacc., Bartlett Cove.
- F. nivale* (Fr.) Ces., Douglas.
- Helminthosporium teres* Eidam, Bartlett Cove; Near Russell Is.
- Ovularia pusilla* (Ung.) Sacc. & D. Sacc., Sandy Cove; Bartlett Cove.
- Phaeoseptoria festucae* Sprague, Tlingit Point.
- Puccinia pygmaea* Eriks., Cordova.
- Scolecotrichum graminis* Fckl., Kenai.
- Septogloeum oxysporum* Sacc., Bomm. & Rouss., Sandy Cove.
- Septoria nodorum* Berk., Beartrack Cove; Bartlett Cove; Sebree Is.
- S. passerinii* Sacc., Herbert River Valley; Sandy Cove.

HORDEUM JUBATUM L.

- Scolecotrichum graminis* Fckl., Berg; Circle; Fairbanks.
- Ustilago bullata* Berk., Circle; Rampart.

HORDEUM VULGARE L.

- Helminthosporium gramineum* Rab., Fairbanks; Matanuska; Wasilla.
- Scolecotrichum graminis* Fckl., Matanuska.
- Ustilago hordei* (Pers.) Lagerh., Matanuska.
- U. nuda* (Jens.) Rostr., Matanuska.

HORDEUM sp.

- Heterosporium hordei* Bub., Matanuska.

PHALARIS ARUNDINACEA var. PICTA L.

- Fusarium nivale* (Fr.) Ces., Juneau
Colletotrichum graminicola (Ces.) Wils., Juneau.

PHLEUM ALPINUM L.

- Darluca filum* (Biv.) Cast., on rust. Juneau.
Fusarium acuminatum Ell. & Ev., near Mendenhall Glacier.
Heterosporium phlei Gregory, Cooper Sta. 26 near Russell Is.; Red Mountain;
 Near Mendenhall Glacier.
Mastigosporium rubricosum (Dearn. & Barth.) Nannf., Mt. Gastineau;
 Mendenhall River Valley.
Ovularia pusilla (Ung.) Sacc. & D. Sacc., Tlingit Pt.
Puccinia poae-sudeticae (West.) Jørst. d., Tunnel 13; Homer;
 Juneau; Tlingit Point; Near Mendenhall Glacier.
Pythium debaryanum Hesse, Near Mendenhall Glacier.
Scolecotrichum graminis Fckl., Homer; Strawberry Is.; Sandy Cove;
 Red Mountain; Muir's Camp; Mendenhall River Valley.

PHLEUM PRATENSE L.

- Claviceps purpurea* (Fr.) Tul., Sitka.
Scolecotrichum graminis Fckl., Homer.
Selenophoma donacis var. *stomaticola* (Bauml.) Sprague & A. G. Johnson,
 Ketchikan.

POA ALPINA L.

- Cylindrocarpum ehrenbergii* Wr., near Russell Is.
Darluca filum (Biv.) Cast., on rust. Mendenhall Glacier area; Muir's Camp;
 Cooper Sta. 33 in Hugh Miller's Inlet; Near Herbert Glacier.
Fusarium avenaceum (Fr.) Sacc., Cooper Sta. 33.
F. nivale (Fr.) Ces., Muir's Camp.
Puccinia poae-sudeticae (West.) Jørst. d., Casement Glacier area; Muir's Camp;
 Cooper Sta. 33 in Hugh Miller's Inlet; Mendenhall Glacier area; Goose Cove;
 Anchorage Cove; Red Mountain; Near Russell Is.; Herbert Glacier area; Steep
 Creek; Muir Is.; Mt. Gastineau; Common near glaciers in s. e. Alaska.
Septoria oudemansii Sacc., Muir's Camp.

POA ANNUA L.

- Botrytis cinerea* Am. Auct., Juneau.
Entyloma dactylidis (Pass.) Cif., Muir Is.
Hendersonia crastophila Sacc., Hoonah.
Leptosphaeria muirensis Sprague, Muir Is.; Auk Village Recreation Area.
Septoria macropoda Pass., Herbert River Valley.

POA ARCTICA R. Br.

- Pleospora magnusiana* Berl., (probably saprophytic). Preobraschenie Is;
 Camden Bay.
Puccinia rubigo-vera (DC.) Wint., Mendenhall Glacier area.
Pythium debaryanum Hesse, in raw soil near Mendenhall Glacier.
Septoria oudemansii Sacc., Mt. Gastineau; Herbert Glacier area.
Spermospora subulata Sprague, Mt. Gastineau

POA COMPRESSA L.

- Erysiphe graminis* Mérat, Muir's Camp.
Fusarium nivale (Fr.) Ces., Satko Cabin on Herbert River.
Helminthosporium vagans Drechs. l., Trail to Mt. Roberts; Juneau.
Septoria oudemansii Sacc., Tlingit Point.
Scolecotrichum graminis Fckl., Muir's Camp; Tlingit Point

POA EMINENS Presl

- Rhynchosporium secalis* (Oud.) J. J. Davis, Kenai.
Septogloeum oxysporum Sacc., Bomm. & Rouss., Unalakleet.

POA EPILIS Scribn.

- Hendersonia crastophila* Sacc., Mt. Gastineau.
Septoria oudemansii Sacc., Mt. Gastineau.

POA GLAUCA Vahl

- Pleospora infectoria* Fckl., (probably saprophytic). Nagai. Cash mentions

that this is a synonym of *P. scrophulariae* (Desm.) Hoehn. sec Lind and E. Mueller.

Puccinia poae-sudeticae (West.) Jørst. , Happy Valley; Kenai Peninsula; Mt. McKinley Natl. Park; Mile 82 on Glenn Highway.

POA INTERIOR Rydb.

Septoria oudemansii Sacc. , Red Mountain.

POA NEMORALIS L.

Puccinia poae-sudeticae (West.) Jørst. , Near Herbert Glacier.

POA LAXIFLORA Buckl.

Ovularia pusilla (Ung.) Sacc. & D. Sacc. , Sebree Is. ; Tlingit Pt.

Rhynchosporium orthosporum Caldwell, Yankee Basin trail.

POA PALUSTRIS L.

Hendersonia culmicola Sacc. , s. f. Eagle River.

Heterosporium avenae Oud. , s. f. Eagle River.

POA PAUCISPICULA Scribn. & Merr.

Puccinia poae-sudeticae (West.) Jørst. , Sandy Cove.

Septoria macropoda f. *sitadakaensis* Sprague, Sandy Cove.

POA PRATENSIS L.

Ascochyta sorghi Sacc. , Homer; Mt. Gastineau.

Botrytis cinerea Am. Auct. , Sitka.

Cercospora poagena Sprague, Hoonah.

Darluca filum (Biv.) Cast. on rust. Hoonah.

Erysiphe graminis Mérat, Skagway; Mendenhall; Homer; Circle; Matanuska;

Talkeetna Mts. ; Fairbanks; Mendenhall Lake; Mt. McKinley;

Kotzebue; Beartrack Cove; Hoonah.

Fusarium acuminatum Ell. & Ev. , Strawberry Is.

Fusarium nivale (Fr.) Ces. , Juneau.

Helminthosporium vagans Drechsl. , Homer; Kenai; Curry; Juneau;

Douglas; Richardson Highway; Ketchikan; Cordova; Strawberry Is. ; Hoonah.

Heterosporium phlei Gregory, Anchorage; Kenai; Homer.

Ovularia pusilla (Ung.) Sacc. & D. Sacc. , s. f. of Eagle River;

Tlingit Point.

Phaeoseptoria festucae Sprague, Juneau.

Pleospora trichostoma (Fr.) Ces. & de Not. , Twelve Mile Summit.

Puccinia poae-sudeticae (West.) Jørst. , Klukwan; Homer; Dunbar; Sitka;

Hoonah; Juneau.

Scolecotrichum graminis Fckl. Homer.

Septoria oudemansii Sacc. , Sebree Is.

POA STENANTHA Trin.

Ascochyta sorghi Sacc. , Red Mountain.

Colletotrichum graminicola (Ces.) G. W. Wils. , Sandy Cove.

Darluca filum (Biv.) Cast. , on rust. Goose Cove Creek.

Erysiphe graminis Mérat, near Mendenhall Glacier.

Fusarium nivale (Fr.) Ces. , Muir's Camp; near Mendenhall Glacier;

Red Mountain.

Helminthosporium vagans Drechsl. , near Mendenhall Glacier.

Heterosporium avenae Oud. , Herbert River Valley; Red Mountain.

Mycelia sterilia, on roots in raw soil. Near Mendenhall Glacier.

Puccinia poae-sudeticae (West.) Jørst. , Valdez; Mendenhall River Valley;

Beartrack Cove; Goose Cove; Anchorage Cove; Muir's Camp; Red Mountain;

Herbert River Valley.

Pyrenochaeta terrestris (Hans.) Gorenz, Walker & Larson, Mendenhall

Glacier area.

Pythium debaryanum Hesse, in raw soil near Mendenhall Glacier.

Rhizoctonia solani Kuehn, near Mendenhall Glacier.

Selenophoma donacis var. *stomaticola* (Bauml.) Sprague & A. G. Johnson,

Steep Creek; Near Russell Is.

Septoria oudemansii Sacc. , Muir's Camp, Mendenhall Glacier Area.

Sphaerella graminum Sacc. & Scalia, (probably saprophytic). Shumagin Is.

POA TRIVIALIS L.

Ascochyta sorghi Sacc. , Juneau.

Puccinia poae-sudeticae (West.) Jørst. , Steep Creek.

Spermospora subulata (Sprague) Sprague f. *ciliata* Sprague, Steep Creek.

POA sp.

Urocystis agropyri (Preuss) Schroet. , Mt. McKinley Natl. Park.

PUCCINELLIA BOREALIS Swallen

Erysiphe graminis Mérat, Circle.

Pleospora trichostoma (Fr.) Ces. & de Not. , Nome.

PUCCINELLIA NUTKAENSIS (Presl) Fern. & Weath.

Puccinia rubigo-vera (DC.) Wint. , near Russell Is.

PUCCINELLIA PAUPERCULA var. ALASKANA Fern. & Weath.

Scolecotrichum graminis Fckl. , Beartrack Cove.

Selenophoma donacis var. *stomaticola* (Bauml.) Sprague & A. G. Johnson,
Hugh Miller Inlet.

PUCCINELLIA PUMILA (Vasey) Hitch.

Fusarium equiseti (Fr.) Ces. , Strawberry Is.

F. nivale (Fr.) Ces. , Strawberry Is.

PUCCINELLIA sp.

Puccinia rubigo-vera (DC.) Wint. , Juneau.

SECALE CEREALE L.

Ustilago nuda (Jens.) Rostr. , mentioned in exp. sta. reports.

TRisetum CERNUUM Trin.

Mastigosporium rubricosum (Dearn. & Barth.) Nannf. , Yankee Basin trail;
Satko Cabin on Herbert River.

Septoria calamagrostidis (Lib.) Sacc. , Yankee Basin trail.

TRisetum SPICATUM (L.) Richt.

Darluca filum (Biv.) Cast. , on rust. Mendenhall Glacier area.

Fusarium nivale (Fr.) Ces. , Mendenhall Glacier area.

Gloeocercospora alaxensis Sprague, Muir's Camp.

Helminthosporium cyclops Drechs. , Red Mountain.

Mycelia sterilia, on roots in raw soil near Mendenhall Glacier.

Puccinia poae-sudeticae (West.) Jørst. , Valdez; Mt. McKinley Natl. Park;
Kotzebue; Muir Is. ; Anchorage Cove near Mendenhall Glacier.

P. rubigo-vera (DC.) Wint. , Talkeetna; Mt. Gastineau; Eagle River;
Mendenhall River Valley; Herbert River Valley.

Pyrenochaeta terrestris (Kuns.) Gorenz, Walker & Larson, Mendenhall
Glacier area.

Pythium debaryanum Hesse, raw soil near Mendenhall Glacier.

Rhizoctonia solani Kuehn (leaf rot), Mendenhall River Valley.

Selenophoma donacis var. *stomaticola* (Bauml.) Sprague & A. G. Johnson
(and ? *Metasphaeria culmifida* Lind), near Mendenhall Glacier.

S. everhartii (Sacc. & Syd.) Sprague & A. G. Johnson, near Mendenhall Glacier.

Septoria calamagrostidis (Lib.) Sacc. , Red Mountain.

TRITICUM AESTIVUM L.

Fusarium graminearum Schwabe, mentioned in station reports.

Tilletia caries (DC.) Tul. , Palmer.

T. foetida (Wallr.) Liro, Matanuska.

Ustilago nuda (Jens.) Rostr. , Palmer; Matanuska.

STATE COLLEGE OF WASHINGTON, TREE FRUIT EXPERIMENT STATION,
WENATCHEE, WASHINGTON



THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS
and

IDENTIFICATION SECTION

AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

FIFTH REVISION OF THE INTERNATIONAL REGISTER OF
PHYSIOLOGIC RACES OF PUCCINIA RUBIGO-VERA (DC.) WINT. F. SP.
TRITICI (ERIKS.) CARLETON = (P. TRITICINA ERIKSS.)¹

Supplement 233

October 15, 1955



The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops Research Branch

Plant Industry Station, Beltsville, Maryland

FIFTH REVISION OF THE INTERNATIONAL REGISTER OF PHYSIOLOGIC
RACES OF PUCCINIA RUBIGO-VERA (DC.) WINT. F. SP. TRITICI (ERIKS.)
CARLETON = (P. TRITICINA ERIKSS.)¹

C. O. Johnston and M. N. Levine

Plant Disease Reporter
Supplement 233

October 15, 1955

The international register of physiologic races of Puccinia rubigo-vera (DC.) Wint. f. sp. tritici (Eriks.) Carleton = (P. triticina Erikss.), the cause of leaf rust of wheat, was last revised in 1951 (7)². Before that there had been periodic additions and revisions (4, 5, 6, 8), following the original description of physiologic races in the leaf rust of wheat by Mains and Jackson (9) in 1926. It is not the intention to review here all of the literature pertaining to physiologic specialization in P. rubigo-vera tritici but merely to cite the source of the original descriptions of new races that are available.

The fourth revision of the international register brought the number of races described to 132. This revision increases the number to 163. An additional 31 races described within four years indicates a continued and possibly increasing interest in leaf rust of wheat in various parts of the world.

Physiologic races 133 to 138, inclusive, were described by Waterhouse (17) in 1952. Races 133, 134, 136, and 137 were obtained from collections in New Zealand, race 135 from collections in both New Zealand and New South Wales, Australia, and 138 from a collection in New South Wales. Waterhouse also described one or more biotypes of each race determined by the addition of Thew or Gaza to the list of standard differential varieties.

Races 139 to 142, inclusive, were described by Brown and Johnson (2) in Canada in 1949. These were isolated in the course of an investigation of the variation in pathogenicity in the leaf rust of wheat under varying greenhouse conditions, but some of the races later were found under natural conditions in the field. Race 143 was discovered by Brown and Johnson in greenhouse studies in Canada in 1952, but the results were not published. A. R. da Silva (13) described Race 144 in 1951 and races 145 to 150, inclusive, were described in a mimeographed report (14) in 1952. All of the races were found in Brazilian collections.

Races 151 to 153, inclusive, were described by Sibilia (11) in 1942 from collections on wheat in Italy. Sibilia (12) also described race 154 in 1939 from a collection in Ethiopia. These four races were overlooked in earlier revisions of the international register of races. Races 25 and 127 also were found in Ethiopia.

The remaining races all were described from collections made in Western and Southern Europe in recent years. Race 155 was described in 1954 by Hassebrauk (3) from a collection in western Germany. Race 156 was described in 1952 by Urries and Cañamas (15), as race A arising from a Spanish collection. They also described races B, C, and D but stated in correspondence later that further experiments indicated those were not new races. Urries and Salazar (16) continued the preceding work and published the results in 1953. Out of 30 cultures described, four proved to be new. These are here assigned the numbers 157 to 160, inclusive. Race number 161 was assigned to a combination of cultures 67b and 68 described by Basile, Leonori-Ossicini, and Rosa (1) in 1954. These authors described several other cultures as possible new races but careful study indicated they probably were only variants of races already described. Race 162 was described in 1954 by Salazar (10) as race E obtained from collections made in Barcelona and Valencia provinces of Spain. He also lists race A which seems to be the same as race 156 described by Urries and Cañamas. Number 163 is assigned to a culture isolated by Cesare Sibilia in Italy in 1954. It has not been described in literature, but the data were furnished by Sibilia in correspondence regarding his culture num-

¹ Field Crops Research Branch, Agricultural Research Service, United States Department of Agriculture in Cooperation with the Agricultural Experiment Stations of Kansas and Minnesota.

² Figures in parentheses refer to "Literature Cited," p. 119.

ber 139. A summary showing the author and year of publication of all races described to date is given in Table 2. The culture and race designations used in the original descriptions of the 31 new races are listed in Table 3. Many other cultures were listed as new races by the authors of those publications but most of them are judged to be merely variations of races already described.

There has been considerable use of supplemental differential varieties by investigators in various parts of the world in recent years. These were used for special reasons, usually concerned with problems related to breeding resistant varieties. In the third and fourth revisions of the international register recognition was given to the supplemental variety Thew and races 95, 96, and 97 were separated by that variety. After careful consideration it seems best to confine physiologic race descriptions to the 8 basic differential varieties selected by Johnston and Mains (8). Therefore race 95 would be considered as a sub-race of race 26 and races 96 and 97 as sub-races of race 68. The eight differential varieties are as follows:

Winter wheat

Malakof C.I. 4898
Hussar C.I. 4834
Mediterranean C.I. 3332
Democrat C.I. 3384

Spring wheat

Carina C.I. 3756
Brevit C.I. 3778
Webster C.I. 3780
Loros C.I. 3778

The winter varieties are typical of common wheat Triticum vulgare Vill., while the spring varieties, also T. vulgare, are of Asiatic types differing considerably from the ordinary wheats of Europe and America.

The reaction classes used in the analytical key are based upon the infection types as listed below:

resistant = 0, 0-1, 1-, 1, 1+, 2-, 2, 2+, 1-2, 0-2
intermediate or variable = x, 1-3, 1-4, 2-3, 2-4, 1-x, 2-x, x-3, x-4
susceptible = 3, 3+, 4-, 4, 4+, 3-4, 3-4+, 4-3

Analytical key for the identification of physiologic races of
Puccinia rubigo-vera tritici determined on the basis of their parasitic
behavior on differential varieties of Triticum vulgare

	Race No.
Malakof resistant	
Carina resistant	
Brevit resistant	
Webster resistant	
Loros resistant	
Mediterranean resistant	
Hussar resistant	
Democrat resistant-----	1, 1
Democrat susceptible-----	124
Hussar susceptible-----	53
Mediterranean susceptible	
Hussar resistant	
Democrat resistant-----	92
Democrat susceptible-----	15
Hussar intermediate or variable-----	34
Hussar susceptible-----	2
Loros intermediate or variable	
Mediterranean resistant-----	74
Mediterranean susceptible-----	3
Loros susceptible	
Mediterranean resistant	
Democrat resistant-----	38
Democrat susceptible-----	33
Mediterranean intermediate or variable-----	44
Mediterranean susceptible	
Hussar resistant	
Democrat resistant-----	163
Democrat susceptible-----	161
Hussar susceptible-----	141
Webster intermediate or variable	
Hussar resistant-----	90
Hussar intermediate or variable-----	136
Webster susceptible	
Loros resistant-----	159
Loros susceptible	
Mediterranean resistant-----	139
Mediterranean susceptible-----	140
Brevit intermediate or variable	
Loros resistant-----	63
Loros intermediate or variable	
Mediterranean resistant-----	79
Mediterranean intermediate or variable-----	111
Mediterranean susceptible-----	102
Loros susceptible-----	32
Brevit susceptible	
Webster resistant	

*Can be separated by variety Thew.

Loros resistant	
Hussar resistant-----	123
Hussar susceptible-----	120
Mediterranean susceptible	
Hussar resistant-----	25
Hussar intermediate or variable-----	59
Hussar susceptible-----	62
Loros susceptible	
Mediterranean resistant	
Hussar resistant-----	11
Hussar susceptible	
Democrat resistant-----	14
Democrat susceptible-----	51
Mediterranean susceptible	
Hussar resistant	
Democrat resistant-----	156
Democrat susceptible-----	58
Hussar susceptible-----	61
Webster susceptible-----	157
Carina intermediate or variable	
Brevit resistant	
Hussar resistant-----	46
Hussar susceptible-----	133
Brevit intermediate or variable	
Webster resistant	
Mediterranean resistant-----	132
Mediterranean intermediate or variable-----	98
Webster intermediate or variable	
Mediterranean resistant-----	135
Mediterranean intermediate-----	137
Mediterranean susceptible-----	81
Webster susceptible	
Loros intermediate or variable-----	138
Loros susceptible	
Democrat intermediate or variable-----	142
Democrat susceptible-----	88
Brevit susceptible	
Webster intermediate or variable	
Mediterranean resistant-----	106
Mediterranean susceptible-----	76
Webster susceptible-----	134
Carina susceptible	
Brevit resistant	
Webster resistant	
Loros resistant-----	153
Loros susceptible	
Hussar resistant-----	154
Hussar susceptible-----	155
Webster susceptible	
Mediterranean resistant-----	18
Mediterranean susceptible-----	45

	Race <u>No.</u>
Brevit susceptible	
Webster resistant	
Loros resistant	
Hussar resistant-----	127
Hussar susceptible	
Democrat resistant-----	56
Democrat susceptible-----	151
Loros susceptible	
Mediterranean resistant	
Hussar resistant-----	131
Hussar susceptible	
Democrat resistant-----	26, 95*
Democrat susceptible-----	158
Mediterranean intermediate or variable-----	78
Mediterranean susceptible	
Hussar resistant	
Democrat resistant-----	4
Democrat susceptible-----	84
Hussar susceptible-----	12
Webster intermediate or variable	
Mediterranean resistant	
Hussar intermediate or variable-----	72
Hussar susceptible-----	66
Mediterranean intermediate or variable	
Hussar resistant-----	75
Hussar susceptible-----	71
Mediterranean susceptible	
Democrat resistant-----	55
Democrat susceptible-----	85
Webster susceptible	
Loros resistant-----	118
Loros susceptible	
Mediterranean resistant	
Hussar resistant-----	68, 96, 97
Hussar susceptible-----	107
Mediterranean intermediate or variable-----	87
Mediterranean susceptible	
Hussar resistant	
Democrat resistant-----	86
Democrat susceptible-----	143
Hussar intermediate or variable	
Democrat resistant-----	73
Democrat susceptible-----	162
Hussar susceptible	
Democrat intermediate or variable-----	67
Democrat susceptible-----	57

* Can be separated by the variety Thew

Race
No.

Malakof intermediate or variable	
Carina resistant	
Mediterranean resistant-----	36
Mediterranean susceptible-----	100
Carina intermediate-----	116
Carina susceptible	
Brevit resistant-----	23
Brevit susceptible	
Webster resistant	
Mediterranean resistant	
Hussar resistant-----	22
Hussar intermediate or variable-----	69
Webster susceptible-----	70
Malakof susceptible	
Carina resistant	
Brevit resistant	
Webster resistant	
Loros resistant	
Mediterranean resistant	
Hussar resistant-----	93
Hussar susceptible-----	17
Mediterranean susceptible	
Hussar resistant-----	5
Hussar susceptible-----	52
Loros intermediate or variable-----	103
Loros susceptible	
Mediterranean resistant	
Hussar resistant-----	37
Hussar susceptible-----	128
Mediterranean susceptible	
Hussar resistant-----	126
Hussar susceptible-----	28
Webster susceptible	
Loros resistant	
Mediterranean resistant	
Hussar resistant-----	125
Hussar susceptible-----	121
Mediterranean susceptible	
Hussar resistant-----	7
Hussar intermediate or variable-----	60
Loros susceptible	
Mediterranean resistant	
Hussar resistant-----	9
Hussar intermediate or variable-----	27
Hussar susceptible	
Democrat resistant-----	31
Democrat susceptible-----	99
Mediterranean susceptible	

	Race No.
Hussar resistant-----	35
Hussar susceptible-----	130
Brevit intermediate or variable	
Loros intermediate or variable-----	110
Loros susceptible-----	83
Brevit susceptible	
Webster resistant	
Mediterranean resistant	
Hussar resistant-----	50
Hussar susceptible-----	64
Mediterranean susceptible	
Hussar resistant-----	105
Hussar susceptible-----	6
Webster intermediate-----	148
Webster susceptible	
Loros resistant-----	119
Loros susceptible	
Mediterranean resistant	
Hussar resistant-----	152
Hussar susceptible-----	147
Mediterranean susceptible	
Hussar resistant-----	8
Hussar susceptible-----	149
Carina intermediate or variable	
Brevit resistant-----	41
Brevit intermediate or variable	
Webster resistant-----	39
Webster intermediate or variable	
Loros intermediate or variable-----	113
Loros susceptible	
Mediterranean resistant-----	29
Mediterranean intermediate or variable	
Hussar resistant-----	65
Hussar susceptible-----	101
Mediterranean susceptible-----	89
Webster susceptible	
Mediterranean intermediate-----	112
Mediterranean susceptible-----	30
Brevit susceptible	
Webster resistant	
Hussar resistant-----	160
Hussar susceptible-----	109
Webster intermediate or variable	
Mediterranean resistant-----	146
Mediterranean intermediate or variable-----	80
Mediterranean susceptible	
Hussar intermediate or variable-----	104
Hussar susceptible-----	145
Webster susceptible-----	42

Carina susceptible	
Brevit resistant	
Webster resistant-----	40
Webster susceptible	
Loros resistant-----	47
Loros susceptible	
Mediterranean resistant	
Hussar resistant-----	19
Hussar susceptible	
Democrat resistant-----	13
Democrat intermediate or variable----	24
Mediterranean intermediate or variable-----	48
Mediterranean susceptible	
Hussar resistant-----	54
Hussar susceptible-----	21
Brevit intermediate or variable	
Hussar resistant-----	82
Hussar susceptible-----	94
Brevit susceptible	
Webster resistant	
Mediterranean resistant	
Hussar resistant-----	43
Hussar susceptible-----	49
Mediterranean susceptible	
Democrat resistant-----	129
Democrat susceptible-----	144
Webster intermediate or variable	
Mediterranean resistant-----	108
Mediterranean susceptible	
Hussar resistant-----	114
Hussar susceptible-----	150
Webster susceptible	
Loros resistant-----	91
Loros susceptible	
Mediterranean resistant	
Hussar resistant-----	10
Hussar susceptible	
Democrat resistant-----	20
Democrat susceptible-----	117
Mediterranean intermediate-----	115
Mediterranean susceptible	
Hussar resistant-----	122
Hussar susceptible	
Democrat susceptible-----	77

Table 1. Reaction of differential varieties of *Triticum vulgare* to physiologic races of *Puccinia rubigo-vera tritici*

Physio- logic Races	Type of Infection on							
	Malakof C.I. 4898	Carina C.I. 3756	Brevit C.I. 3778	Webster C.I. 3780	Loros C.I. 3779	Mediterranean C.I. 3332	Hussar C.I. 4843	Democrat C.I. 3384
1	0	0	0	0	0	1	1	0
2	0-1	0-1	0-1	0	0-1	4	3-4	4
3	0-1	0-2	2-2+	0-2	2-4	3-4	0-1	4
4	0-1	4	4	1	3-4	3-4	2-2+	1-2
5	4	0	0-1	0-1	0-1	4	0-2+	4
6	4	2	4	1-2	3	3-4	3	3-4
7	4	1-2	1	4	1	4	1	4
8	4	1	4	4	4	3-4	1	1
9	4	1-2	1-2	4	4	0-1	1-2+	0-1
10	4	4	4	4	4	1-2	1-2	1-2
11	0	2-	3-4	1-2+	3-4	1-2	0-2	0-2
12	0	4	4	1	4	4	4	4
13	4	4	2-	4	4	0	4	0
14	0	2-	4	1	4	0	4	0
15	0	0	0-1	0	0-1	4	0-1	4
16	2	2	2	2	2	1	2	1
17	4	0	0	0	0	0	4	0
18	0	4	2	4	4	0	4	0
19	4	4	2	4	4	0	1	0
20	4	4	4	4	4	0	4	0
21	4	4	2	4	4	4	4	4
22	X	4	4	1-2	4	0-1	0-1	0-1
23	X	4	2	4	4	0	4	0
24	4	3-4	1-2	4	4	0-2	4	X
25	0	2	4	0	2	4	0	4
26	0	4	4	0	4	0	4	0
27	3-4	2	1-2	3-4	3	2	2-3	2-3
28	4	1+	1+	2+	3	4	3	4
29	4	2-3	2-3	2-3	4	1-2+	3	1
30	4	2-3	2-3	3	3-4	4	1-2+	4
31	4	2	1-2	4	4	1-2	3-4	1-2
32	0	2	X	1-2	3-4	4	1-2	4
33	0	1	2+	0-1+	4	2+	1	4
34	0	0	0	0-1	1	4	X	4
35	4	2+	2+	4	4	4	1	4
36	2-3	0	0-2	0	0-2	2+	1-2	2+
37	3-4	2+	2	0-2	3-4	2+	2	2+
38	0	2-2+	1-2	0-1	3-4	2+	1-2	2+
39	3-4	2-3	2-3	0-1	4	3-4	0-1	3-4
40	4	4	2	0	3-4	4	4	2-3
41	4	2-3	2	4	4	2	2	3-4

Type of Infection on

Mediterranean

Physio- logic Races	Malakof C.I. 4898	Carina C.I. 3756	Brevit C.I. 3778	Webster C.I. 3780	Loros C.I. 3779	Mediter- anean C.I. 3332	Hussar C.I. 4843	Democrat C.I. 3384
42	4	2-3	3	4	4	3-4	4	4
43	4	3	3	1-2	4	1	2	1-2
44	0	2	2	0-2	4	X	0-1	4
45	0	3-4	2+	4	4	3-4	2	3-4
46	0-1	2-3	2	0-1	4	2	1-2	3-4
47	4	3	2	4	0	2	0	2
48	4	3-4	2	4	4	2-3	2	0
49	4	3	3	2	3-4	0	4	0
50	4	2	4	2-	3	0	2	0
51	0	1	3	1	3	2	3	3
52	4	0	1	0	1	4	3	4
53	0	1	2	1	1	0	3	0
54	4	4	2-	4	4	4	0	4
55	0	3	4	2-3	4	3	4-3	1-2
56	0	3	4	2	2	3	4-3	1
57	0	3-4	4	3-4	4	4	3	3
58	0	2	4-3	1	3	4	2	4
59	2	1-2	4	1-2	1	3	2-3	4
60	4	0	1	4	0-1	4	2-3	4
61	0	1-2	3	0	3	4	4	4-3
62	0	0	4	0	0-2	4	3	4
63	0	1-2	2-3	0-1	1-2	1-2	0	1-2
64	4	1	3	1	3	1+	4	1+
65	4	X	X	X	4	X	1-2+	X
66	0	3-4	4	2-3	4	0-1	4	0-1
67	0	4	4	3-4	4	3-4	3-4	2-3+
68	0	3-4	4	3-4	4	0-1	1-2	0-1
69	2-4	3	3-4	1-2	3-4	0-1	2-3	0-1
70	2-4	3-4	3-4	3	3-4	0-1	0-2	0-2
71	0	4	4	2-3	4	2-3	3-4	1-1+
72	0-1	3-4	4	2-3	4	0-1	X-4	0-1
73	0	3-4	4	3-4	4	3-4	X-4-	1-2
74	0	0	0-1	0	2-3+	0-1	0-1	0
75	0	4	4	2-3	4	2-3	0-1+	0-1
76	0	X	3-4	X	3-4	4	0-2+	4
77	4	4	4	4	4	4	4	4
78	0	3-4	3-4-	1-2+	4	X	X	X
79	0	0-1	X	0-1-	X	0-2+	0-1	X
80	4	X	3-4	X	4	X	4	X
81	0	X	X	X	X	4	1-2+	4
82	4	3-4	X	4	4	X	1-2+	3-4
83	4	1-2+	X	0-1-	3-4	X	0-2+	4
84	0	3	4	1	3-4.	4	0-1	4

Physio- logic Races	Type of Infection on							
	Malakof C.I. 4898	Carina C.I. 3756	Brevit C.I. 3778	Webster C.I. 3780	Loros C.I. 3779	Mediterranean C.I. 3332	Hussar C.I. 4843	Democrat C.I. 3384
85	0	4	4	2-3	4	4	3	4
86	0	4	4	3	4	4	1	1
87	1	4	4	3	4	X	2	X
88	1	2-3	2-3	3	4	X	1	4
89	4	X	X	X	4	4	4	4
90	1	2	2	X	4	4	1	4
91	4	4	4	4	0-1	0-1	3-4	0-1
92	0	0-1	2	0	0	4	2	2
93	4	0	1	1	2	1	1	1
94	4	4	X	4	4	2-4	4	4
95	0	4	4	0	4	0	4	0
96	1	4	4	4	4	1	1	0
97	1	4	4	4	4	1	1	0
98	0	2-3	2-3	1-2	2-3	2-3	2-3	2-3
99	4	2	2	4	4	0	4	4
100	X	0	0	0	1	4	1-3	4
101	4	2-3	2-3	X	3	X	3	X
102	0	0-2	1-3	0-1	0-4	4	0-3	4
103	4	0-1	1-2+	0-1	X-3	0-X	0-1	0-3
104	4	2-4	3-4	2-4-	4	4	1-3+	4
105	4	1-2	3+	0-1	3+	4	1	4
106	0	2-3	3-4	2-3	3	0	0	0
107	0	4	4	4	4	1-2	3-4	1-2
108	4	4	4	2-3	4	0-1	3-4	0-2
109	4	2-4+	4+	2+	0	0	3	4
110	4	0-1-	1-3	0	2-4-	0-1-	0-1-	0-1
111	0	0-1+	0-3+	0-1-	0-4	1-4	0-1+	4
112	4	2-4	1-3-	4	4	X	1-3+	4
113	4	X	X	X	X	4	2-2+	4
114	4	4	4	2-3	4	4	2+	4
115	4	4	4	4	4	X	X	X
116	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2-3
117	4	4	4	4	4	0	4	4
118	0	3	4	4	0	0	0	0
119	4	0	4	4	0-1	0-1	4	0
120	1	0-1	3-4	0	0	0	4	0
121	4	0	0	4	0-1	0	4	0
122	4	4	4	4	4	4	2	4
123	0	0	4	0	0	0	0	0
124	0	0	2-	0	2-	2	1	4
125	3	2	2	4	2	0	2	0
126	4	1	2	1	4	4	2-	4
127	0	3	3	1	2	3	1-	4
128	4	2	2	1	3	0	4	0

Physio- logic Races	Type of Infection on							
	Malakof C.I.	Carina C.I.	Brevit C.I.	Webster C.I.	Loros C.I.	Mediterranean C.I.	Hussar C.I.	Democrat C.I.
	4898	3756	3778	3780	3779	3332	4843	3384
129	4	3	4	0	4	4	4	2+
130	4	1+	1+	3+	3+	3+	3	3+
131	0	3	3	2	4	0	2+	0
132	0	2-3	2-3	0-1	2-3	0	0	0
133	0	X	1	1	4	0	4	0
134	1	X	4	4	4	1	1	0
135	0	X	X	X	X	0	X	0
136	0	1	1	X	X	4	X	4
137	0	X	X	X	X	X	X	0
138	0	X	X	4	X	0	X	0
139	0	1	1	3	3	2	1	2
140	0	2+	2+	3	3	3+	1	3+
141	0	2+	2+	2+	3	3	3	3
142	0	2-3	2-3	3	3	2-3	1	2-3
143	0	4	4	4	4	4	2-	4
144	4	3	4	0	4	4	3	4
145	4	X	4	X	4	4	4	4
146	4	X	4	X	4	0	4	0
147	4	2	4	4	4	0	4	0
148	4	2	3	X	4	0	4	0
149	4	2	4	4	4	4	4	4
150	4	4	4	X	4	4	4	4
151	0	4	3++	0	2	3++	3	4
152	4	1	3	3	4	1	1	4
153	0	3	2	2	2	4	4	4
154	0	3	1	1	4	1	0	2
155	0	4	0-2	0	4	2	3	0-2
156	0;	1+	4-	1-	3+	4-	2-	1
157	0	2	3-	3-	3-	3-	1	0
158	0	3+	3+	2	3+	1	3+	3
159	0;	1	2	3	1	4	1	4
160	4-	X	3	1	1+	0;	1	0;
161	0	2	2	1	4	4-	1	3
162	1	3	4	4	4	4	X	4
163	0	1	2+	0	3	3	1++	2

Table 2. Information on original descriptions, place and year of discovery or report of physiologic races of Puccinia rubigo-vera tritici

Physiologic Races	Described by	Country or Area	Year
1-12	Mains and Jackson	United States	1926
13-23	Scheibe	Western Europe	1930
16	Arkina	Russia	1941
24	Dodoff	Bulgaria	1931
25	Tschalakow	Germany	1931
26	Waterhouse	Australia	1929
27	Johnston	United States	1930
28-50	Johnston and Mains	do.	1932
51-53	Schaal, Stakman, and Levine	do.	----
54	Radulescu	Rumania	1932
55-62	Sibilia	Italy	1935
63	Mehta	India	1933
64	Rudorf, Job, and Rosensteil	Argentina	1933
65	Caldwell and Compton	United States	1936
66-75	Roberts	England, Wales, Portugal	1936
76-83	Caldwell and Compton	United States	1936
84-86	Sibilia	Italy	1936
87-90	Newton and Johnson	Canada	1936
91	Buchheim and Lissitzyna	Russia	1934
92-94	Hassebrauk	Germany	1937
95-97	Waterhouse	Australia	1929, 1932
98-99	Rashevskaya and Barmenkov	Russia	1935
100	Caldwell and Compton	United States	1937
101	Newton and Johnson	Canada	1937

Physiologic Races	Described by	Country or Area	Year
102-105	Caldwell and Compton	United States	1931-1938
106-108	Mehta	India	1938
109	Verwoerd	South Africa	1937
110-113	Caldwell and Compton	United States	1940
114	Vallega	Chile	1941
115, 116	Rashevskaya and Barmenkov	Russia	1937
117-121	Barmenkov	Russia	1937
122	Vohl	Europe	1938
123	Asuyama	Japan	1939-1940
124-129	Johnston	United States	1935-1941
130	Newton and Johnson	Canada	1942
131	Johnston	United States	1947
132	Mehta	India	1950
133-138	Waterhouse	New Zealand and Australia	1952
139-142	Brown and Johnson	Canada	1949
143	do.	do.	1952
144-150	Silva	Brazil	1951, 1952
151-153	Sibilia	Italy	1943
155	do.	Ethiopia	1939
155	Hassebrauk	Germany	1952
156	Urries and Cañamas	Spain	1952
157-160	Urries and Salazar	do.	1953
161	Basile, Leonori-Ossicini, and Rosa	Italy	1954
162	Salazar	Spain	1954
163	Sibilia	Italy	1955

Table 3. Authors and culture numbers used by them in describing physiologic races to which the register numbers 133 to 163, inclusive, have been assigned.

Race No.	Author and Citation	Authors' Culture or Race Numbers
133	W. L. Waterhouse (17)	133A
134	do	134B
135	do	135A, 135B, 135AB, 135BB
136	do	136A
137	do	137B
138	do	138AB, 138BB
139	A. M. Brown and T. Johnson (2)	C1
140	do	C2
141	do	C3
142	do	C4
143	do (not published)	1946-1
144	A. R. da Silva (13)	RN1
145	do (14)	RN4
146	do	RN7
147	do	RN8
148	do	RN9
149	do	RN10
150	do	RN11
151	C. Sibilial (11)	B
152	do	R1
153	do	R2
154	do (12)	E.2
155	K. Hassebrauk (3)	Münster
156	M. J. Urries and R. Cañamas (15)	903, Race A
157	M. J. Urries and J. Salazar (16)	1064
158	do	1183
159	do	1238
160	do	1243
161	R. Basile, A. Leonori-Ossicini e M. Rosa (1)	67b and 68, races 630111
162	J. Salazar (10)	1370, race E
163	C. Sibilial (not published)	139

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THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS

and

IDENTIFICATION SECTION

AGRICULTURAL RESEARCH SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

SYSTEMIC CHEMICALS

Supplement 234

November 15, 1955



The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

THE PLANT DISEASE REPORTER SUPPLEMENT

Issued by

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops Research Branch

Plant Industry Station, Beltsville, Maryland

Papers From The Symposium On

SYSTEMIC CHEMICALS

presented at the Wooster meeting
North Central Division, American Phytopathological Society
Wooster, Ohio, August 8, 1955

Plant Disease Reporter
Supplement 234

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INTRODUCTORY REMARKS

By H. C. Young, Moderator of the Symposium

The present status of disease control involves a savings of approximately 50 percent of the losses caused by plant diseases. This 50 percent control is brought about by 1) protective fungicides, 2) resistance by breeding, 3) sanitation, cultural practices and several other factors. A large part of the 50 percent not now being controlled is due to 1) faulty methods, or 2) internal diseases for which protective chemicals are inadequate or have no effect. Examples of these are the diseases caused by: (a) fungi that gain entrance and operate internally in plants such as many root rots; (b) most bacterial diseases, of which there are many serious ones; and (c) the virus disease group. As a challenge it is being said, for the present, that the diseases not being adequately controlled are increasing and that the plant pathologist at the moment is slightly on the losing side. It is because of this situation that a tremendous effort is being made to develop new methods, and new chemicals that may prove to be more effective.

Because of the type of disease control that is required, attention at present is concentrated upon chemicals that penetrate the host tissue, and better still, on those that would be translocated throughout the host plant. The interest that is being manifested in this phase of plant disease control is extensive. Many industrial concerns are giving it a major portion of their research program. Many State and Federal projects are being set up for similar study.

The term "systemics" should be defined for this conference. Suppose we have it include any chemical that is absorbed by the host and may or may not be translocated. Also let it include any chemical that will control disease after infection has taken place. These same chemicals may prevent disease as well.

There are two types of chemicals to be included in this discussion, namely those listed as antibiotics and those put together in the chemical laboratory. Antibiotics are being widely tested and many are showing promise in the pest control field. In all likelihood a number of the diseases not now being controlled will succumb to this treatment. The synthetic chemical compounds are also being widely tested and a very promising role can be predicted for them.

There are many other factors that should be discussed by this group: the effect of systemics on the host plant itself; the change that may take place in the chemical compound; the toxicity to the plant and to the parasite; and new methods for evaluating control materials.

The primary reasons for setting up this symposium were twofold. First, it is a new and complicated field of research that has direct application to the economics of agriculture. Second it is a part of a project sponsored by the Agricultural Research Institute and is of immediate interest to both industry and State and Federal agencies.

Since it is desirable to have as many points of view as possible, it was decided to limit each report to 5 minutes. An open discussion will follow the formal talks.

OHIO AGRICULTURAL EXPERIMENT STATION

FOREWORD

Based on remarks made by W. E. Krauss, Associate Director of the Ohio Agricultural Experiment Station, at the symposium on systemics, August 8, 1955, and at a joint dinner meeting of the North Central Section of the American Phytopathological Society and the Ohio Pesticide Institute, August 9, 1955.

The Administration and Staff of the Ohio Agricultural Experiment Station are always happy to have groups visit our institution. Through its 13 departments covering all areas of agricultural research, its vast facilities extending throughout the State at many locations, its devoted scientific staff and other workers numbering about 500, the Ohio Agricultural Experiment Station is able, with the support of public funds and grants from industry, to attack many of the urgent problems of agriculture and to transmit the findings to science and the general public through all the common means of communication of which direct visitation is one.

This group is interested in the whole field of pesticides, some of you primarily in that area which centers around phytopathology. Some of you are employed by industry, some of you by public institutions, but all of you have a common interest -- namely, to reduce losses in agriculture resulting from diseases, insects, weeds, and other pests. Agricultural chemicals, as well as genetics and cultural practices, are the basic tools with which you work to develop control measures, to develop resistance or to reduce losses through improved cultural practices.

Development of agricultural chemicals for pest control has of necessity brought industry and public institutions closer together. This is as it should be, for they are dependent upon each other and require each other's talents and resources jointly to move forward in the battle against more than a ten billion dollar annual loss.

The same trend in industry-institution relationships is apparent in other areas of agricultural research. President Eisenhower and Secretary of Agriculture Benson expressed this need early in their administration. The numerous commodity advisory committees now operating testify to this belief. In addition, creation of the Agricultural Research Institute, sponsored by the National Academy of Sciences and working side by side with the Agricultural Board of the National Research Council, provides opportunity for all industry interested in agriculture and all institutions and federal agencies working in agriculture to consider jointly the problems of agriculture and suggest studies and activities that will help in their solution. Of particular interest to this group was the formation within the Agriculture Board during the past year of a committee on agricultural pests, and laying of the groundwork for holding this fall the first international antibiotics congress.

The Ohio Agricultural Experiment Station is only one of many public institutions conducting extensive research programs involving reduction of losses from pests. In our program the Departments of Botany and Plant Pathology, Entomology, Agronomy, Horticulture, Forestry, Agricultural Engineering, Animal Science, Dairy Science, and Veterinary Science are all involved. The program is not limited to evaluation of agricultural chemicals for pest control but includes development of formulations, physiological responses, soil and plant residues, and extensive breeding programs with field and horticultural crops to develop natural resistance. The race is on between the plant breeder and those who feel that chemical control will be the final solution. Undoubtedly the use of agricultural chemicals for pest control will increase, but development of increased resistance or immunity through breeding must continue. Both approaches can supplement each other. One of the great areas for research in the future lies in study and control of soil-borne organisms like nematodes. Here, too, use of chemicals as well as genetics and cultural practices must go hand in hand.

As population continues to increase and new acreages of productive land become more difficult to obtain, the need for reducing losses becomes as great as the need for increased production. On the basis of statistics provided in the publication "Annual Losses in Agriculture, 1942 to 1951", nearly 120 million fewer acres of cropland would have produced the needed food, feed and fiber if all losses had been eliminated; 90 million fewer acres if all pest damage had been eliminated. In other words, it would be potentially possible to provide the food, feed and fiber needs of an anticipated population of more than 200 million by 1975 from present acreages.

This is a challenge in the meeting of which this group can play a significant part.

OHIO AGRICULTURAL EXPERIMENT STATION

ANTIBIOTICS AS SYSTEMIC FUNGICIDES

John L. Lockwood

Antibiotics have given spectacular results in controlling a number of diseases of plants. Beside the fact that they are highly potent compounds, and are relatively non-toxic to higher plants, there is evidence that their effect is due to the entry of the antibiotics into the plant tissues. For example, in greenhouse tests, Jonathan apple saplings sprayed with streptomycin, then inoculated a day later with the fire blight bacterium (*Erwinia amylovora*) do not ordinarily develop symptoms. Moreover, the fact that streptomycin and Actidione are effective as post-infection sprays for certain diseases indicates that these antibiotics must be acting within the plant.

As yet we know very little about how an antibiotic penetrates or how it acts once it gets inside. Workers at Merck and Co., using a washoff method, have recently found that the more soluble formulations of streptomycin penetrate most readily, and that the addition of glycerine to formulations enhances penetration. Increased penetration of the antibiotic was correlated with increased disease control in greenhouse experiments. Using a leaf disk method, we have found that penetration of streptomycin into leaf tissue is increased in a moist atmosphere, and that the amount detected within the leaf may depend on the age of the leaf and the part of the leaf assayed. Such methods should be of use in increasing our understanding of penetration, and as tools in searching for systemic toxicants.

Many antibiotics are translocatable in plants, as evidenced by root and cut stem uptake studies. Absorption and distribution of an antibiotic appear to be influenced partly by the antibiotic and partly by the plant. The antibiotics so far investigated are translocated primarily in a distal direction. It would seem that translocation in the opposite direction would increase the chances of controlling such diseases as root rots and wilts.

The action of an antibiotic within a plant in controlling a disease is presumably by direct toxicity to the pathogen. There are several cases, however, in which streptomycin affords control of fungus diseases, the incitants of which are unaffected by the antibiotic *in vitro*. It would thus appear that antibiotics may alter the host physiology in such a way as to confer resistance to the disease.

Antibiotics are an important source of systemically active fungicides and bactericides. A great deal of basic information must be learned as to how they penetrate, how they move in the plant, and how they act on pathogens before we can use them effectively, or even evaluate them intelligently.

OHIO AGRICULTURAL EXPERIMENT STATION

THE ROLE OF PHYSIOLOGY AND BASIC RESEARCH

Gordon A. Brandes

There is no doubt that chemotherapy or the systemic disease control agents offer many advantages in plant disease control over the conventional methods and materials in use today. We must not, however, underestimate the complexities of the development and application of this new method. We must avoid thinking of chemotherapy as simply an improvement in the old art of "squirt gun botany".

At least two means of attack are available.

1. We could initiate a crash program of synthesizing and testing thousands of likely candidate compounds, or
2. We can start with more basic research on the plant physiology and biochemical aspects of the problem.

The first approach requires a high element of luck and, even then, offers only limited chances for lasting success.

A more fundamental approach involving the basic physiology and biochemistry seems to be the only sound way to get at the heart of this problem. Our company and many others have been engaged in screening compounds as plant chemotherapeutants for several years. To date no one has come up with much which has practical application in the field but certain workers are now on the trail of some encouraging leads. It has been necessary first to develop an entirely new concept of screening procedures and test methods. Two principles that have become very evident are: 1) fungi-toxicity, *per se*, is not a prerequisite of a useful chemotherapeutant, and 2) *in vitro* testing is not indicative of the true worth of a compound for internal plant disease control.

Compounds with reasonably high fungitoxicity *in vitro* are frequently too phytotoxic to the host when introduced into the plant. The few compounds which have shown some promise so far as chemotherapeutants have shown very little if any fungitoxicity. Yet when these compounds are put into the plant they do suppress the expression of disease symptoms. We can assume, therefore, that these compounds in some way alter the basic physiology, chemistry, or even morphology of the plant to render it less susceptible to attack; or they may alter the basic metabolism of the pathogen itself or neutralize the toxins it produces. Some of the more promising leads in chemotherapy have been found recently in the so-called "growth regulators" related to 2,4-D. It has been demonstrated that the susceptibility of a plant to a certain virus may be decreased with indolacetic acid and increased with maleic hydrazide. I believe there is real hope for the suppression of virus diseases with chemicals once we learn more of the basic facts of their behavior.

I have always been intrigued with the possibility that the basis of disease resistance in many new crop varieties can be attributed to the introduction of a chemical factor from the resistant

line of breeding material. Why shouldn't we be able to impart such chemical resistance to a plant artificially?

I have also been amazed and thoroughly impressed with the detailed work that has gone into the new systemic insecticide, Systox. As a result of very thorough and exacting studies into the nature and behavior of this compound within the plant, we now have a fairly good understanding of its absorption, translocation, chemical decomposition, and the real basis for its activity.

I would be one of the last to concede the demise of the "squirr gun botanist", and our conventional methods of plant disease control. I believe we will have to depend for some time on our old-fashioned methods of using protective fungicides for many of our major disease problems. I feel that greater refinement and improvement is still possible with these old standbys. But I will readily agree that even the "squirr gun botanist" has reached the point where he needs to get back to some of the basic fundamentals of botany, plant physiology, and biochemistry if he is to make any further and significant progress. His effort to train his sights on the intricate details of chemical activity within the plant will open the way for important advancements. Using the basic botanical and biochemical knowledge we already have along with the useful new tools, methods, and techniques, it should be possible to isolate, identify, and synthesize the chemical entities that contribute to plant disease control. Applying this knowledge further we can then determine the best way to get these compounds or their parent materials into the plant. It should be academic that a knowledge and understanding of systemic disease control agents is predicated on the knowledge of the "system" itself.

ROHM & HAAS COMPANY, PHILADELPHIA, PENNSYLVANIA

FUNGICIDES FOR MERION BLUEGRASS RUST
(PUCCINIA GRAMINIS) CONTROL
GREENHOUSE EVALUATION

M. C. Shurtleff, J. Troll, and F. L. Howard, University of Rhode Island. (This paper was printed in "Turf Diseases", Plant Pathology Report 4, 1954, and is not repeated here).

THE CHEMICAL CEREAL RUST CONTROL PROJECT
OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

W. Q. Loegering

In 1955 the Field Crops Research Branch started a project on the chemical control of cereal rusts. The 3 phases of this project are: 1) A study of the basic problems involved in the use of "systemic" fungicides for rust control, being done by Dr. J. B. Rowell of the Field Crops Research Branch working in cooperation with the Department of Plant Pathology, University of Minnesota; 2) A study of screening methods under the direction of Dr. J. M. Daly of the Department of Plant Pathology at the University of Nebraska; and 3) Cooperative field testing of promising chemicals. Workers at several experiment stations have indicated an interest in cooperating in such tests as soon as chemicals are found that show promise for rust control in the field. It has been agreed that the nomination of a chemical for cooperative field testing should be supported by favorable data on field control of rust, yield, phytotoxicity, and effect on germination and quality of the seed produced. Also the chemical must be available in sufficient quantity for the trials. If any one knows of any materials that meet these specifications it will be appreciated if they will contact me. It is not planned to initiate cooperative field tests until such chemicals are available.

FIELD CROPS RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE,
U.S. DEPARTMENT OF AGRICULTURE, BELTSVILLE, MARYLAND

THE FUNGICIDAL VALUE OF METHYL BROMIDE
AND ETHYLENE DIBROMIDE WHEN USED AS SOIL FUMIGANTS

J. H. Davidson

Methyl bromide and ethylene dibromide used as soil fumigants for nematode control frequently have shown value in controlling certain soil-borne plant pathogens.

Reports of direct disease control from methyl bromide treatments are rather common. In many cases the concentration of methyl bromide required for disease control is somewhat higher than that used for the control of weeds and nematodes. Newhall and Lear (1) reported good control of the species of Pythium and Fusarium causing damping off of various seedlings. In the same work they also noted kill of sclerotia of Sclerotinia sclerotiorum when soaked prior to treatment. Koch (2) reported control of damping off organisms similar to the above. In addition the tobacco rootrot fungus was also controlled. Perry and Swank (3) working with celery seedbed diseases in Florida found methyl bromide and chlorobromopropene effective in controlling species of Rhizoctonia, Pythium and Fusarium. Lucas and Moore (4) found that methyl bromide gas killed the black shank fungus (Phytophthora) buried 6 inches deep in sandy soil. Munneke and Ferguson (5) found methyl bromide effective in controlling the mycelial mats of certain species of Pythium, Rhizoctonia and Fusarium. Methyl bromide also controlled sclerotia of Sclerotinia sclerotiorum and Sclerotium delphinii. McKeen and Bosher (6) using methyl bromide and ethylene dibromide for nematode control in Verticillium-infested strawberry soil indicated a marked reduction in wilt-affected plants grown on the methyl bromide treated areas and no reduction in wilt in the ethylene dibromide treated area.

Ethylene dibromide when used as a nematocide has not shown any consistent direct fungicidal value. In most cases where the severity of disease has been reduced with ethylene dibromide treatments it has been an indirect effect through control of nematodes that have caused root injury and thus permitted entrance of disease organisms. Miller (7) reporting the work of the Southern Forest Experiment Station concluded that chloropicrin and ethylene dibromide were outstanding in control of root diseases encountered in a nursery near Brooklyn, Mississippi. Smith (8) and Presley (9) indicated in their work that ethylene dibromide probably has little fungicidal value in itself for control of Fusarium wilt disease in cotton. Their experiments indicated, however, that improved cotton yields occurred where soil was treated. They attributed this increased yield to less wilt infection as a result of reduced root injury caused by nematodes. A report from Georgia (10) states that D-D and ethylene dibromide soil treatments have consistently controlled Sclerotium rolfsii on tobacco. Wensley (11) reported that methyl bromide was more active as a fungicide than ethylene dibromide.

Much of the information available on this subject is based on circumstantial observations generally made in conjunction with nematode or weed control studies. A good review of this phase of the subject has been presented by Holdeman (12). In vitro laboratory studies on the fungicidal value of these materials is not sufficient. The fungicidal action of the chemicals on the microflora in soil is a necessary phase to determine their activity against specific soil inhabiting fungi and the plant diseases they cause. Steiner (13) in summarizing this subject, suggests that soil-borne plant diseases are, at least in some instances, of complex character and that nematodes are frequently members of such complexes, acting as initiators, synergists, aggravators, or otherwise.

An additional item of interest in this discussion pertains to the problem involved in planting crops after soil fumigation treatments. It has been found that bromine residues in the soil remaining after treatment with either methyl bromide or ethylene dibromide are not always solely responsible for crop injury. Where toxic effects have been noted it frequently is a result of the treatment on nitrifying soil bacteria. When the population of these organisms is reduced and there is a high ammonia content in the soil, ammonia injury to certain plant species has been observed. Use of nitrate fertilizers and prolonging the aeration period tends to reduce the occurrence of this disorder.

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- THE DOW CHEMICAL COMPANY

THE SYSTEMIC PROPERTY OF STREPTOMYCIN -- ITS ROLE IN COMBATING INFECTIONS OF PLANTS

R. F. Philips

A good deal of information has been reported on the systemic properties of streptomycin. Likewise, it is known that under laboratory conditions infection of certain plants with pathogenic bacteria can be prevented by applying streptomycin in a systemic manner. The importance of systemic streptomycin in combating plant diseases under practical field conditions is not all well-defined. Some authorities are convinced that the disease control achieved by streptomycin sprays is predominantly due to killing of the pathogen by streptomycin acting as a surface protectant.

Unfortunately, no general theory seems to fit all the facts. A number of independent variables makes nearly every situation a distinct case. The plant species involved is a most important variable. The pathogen may be equally important. Other factors that may affect the degree of the systemic action include the concentration, frequency, and mode of application of streptomycin, presence of other components in spray or dust mixtures, and certainly weather conditions. We must not overlook, either, the possibility that streptomycin modifies the biochemistry of the host plant so that the host-pathogen relationship is upset. Perhaps therapeutic action may not always be entirely due to direct attack on the pathogen.

An apparently clear-cut case of systemic action is found in the experiments of Mitchell, Zaumeyer, and co-workers. They applied streptomycin paste to bean stems and demonstrated by microbial assay of leaf tissue that streptomycin was absorbed and readily moved upward in the plant to higher leaves. These leaves were protected against infection when inoculated with the halo blight bacteria (*Pseudomonas phaseolicola*) or with the common blight bacteria (*Xanthomonas phaseoli*). It was not possible to detect any downward movement of streptomycin to lower leaves or roots.

Another line of evidence for systemic action of streptomycin arises from the work with fire blight (*Erwinia amylovora*) of Winter and Young here at Ohio, of Goodman at Missouri and other investigators. Streptomycin sprays protected apple shoots from subsequent infection even though inoculation was done subepidermally by needle puncture. It is hardly possible that a surface layer of streptomycin alone would protect the deep interior tissues. There must have been prior

absorption of streptomycin into these interior tissues -- an effect which might be called paradoxically a "localized systemic action."

In contrast, the control of bacterial spot (*Xanthomonas vesicatoria*) of peppers with streptomycin seems to rely on a surface protective effect rather than on systemic or "localized systemic action." Crossan and Krupka in Delaware found that no streptomycin could be detected in the leaves of pepper plants that were sprayed with streptomycin, allowed to stand for several days, and washed thoroughly before microbial assay. On unwashed plants streptomycin could remain active on the leaf surface for more than seven days.

Only a small fraction of streptomycin applied as a plant spray could be expected to be absorbed by plant tissues under usual conditions. The remainder might persist for a while as a surface coating and serve as a protectant, but the first heavy rain would wash it off. Obviously, a means of securing "rain-proof" protection was much to be desired. One approach was to promote the absorption of larger proportions of streptomycin within the susceptible plant tissues.

Dr. Gray of our laboratories has obtained remarkable success with such an approach in the case of common blight of beans under greenhouse conditions. These results have already been published in the July 15 issue of the PLANT DISEASE REPORTER. The addition of about 1% glycerol to streptomycin sprays caused several-fold increase in the concentration of non-leachable streptomycin absorbed by the bean leaves. Leaves were washed thoroughly before assay and before inoculation with the common blight pathogen. Plants sprayed with 200 ppm of streptomycin alone developed an average of 107 lesions per leaf; plants sprayed with 200 ppm of streptomycin plus 1% glycerol developed only 8 lesions per leaf. The concentration of non-leachable streptomycin in the leaf juice of the plants sprayed with the glycerol combination was 10.1 mcg./ml.; the concentration in the leaf juice of the plants sprayed with streptomycin alone was below the limit of detection, namely less than 1.5 mcg./ml. In these experiments inoculation conditions were severe. The leaves were rubbed with carborundum suspended in a culture of the common blight bacteria.

In addition to beans, the glycerol effect was studied on a number of other plants. Details of these experiments are now being published elsewhere. However, it is sufficient for the present discussion to note that similar several-fold increases of non-leachable streptomycin were observed in leaves of tomato and tobacco. The following details on pepper are interesting because of the evidence mentioned previously that surface protection appeared to be primarily important in controlling bacterial spot;

<u>treatment</u>	<u>ppm streptomycin in leaf juice</u>
100 ppm streptomycin	< 1
100 ppm streptomycin + 1% glycerol	7.6
200 ppm streptomycin	< 1
200 ppm streptomycin + 1% glycerol	17
400 ppm streptomycin	1.3
400 ppm streptomycin + 1% glycerol	40

Perhaps it will be possible now with the glycerol combination to secure longer lasting, more dependable rain-proof protection against bacterial spot of peppers rather than relying on the surface effect alone. Peppers, indeed, seem to be nearly impermeable to streptomycin alone but tractable when glycerol is added.

Up to the present most of our experiments on control of bacterial diseases have been carried out with the bean blight. We hope that the glycerol combination will give as good results against other diseases. Through cooperative experiments we have arranged field trials on a number of important diseases against which streptomycin had previously shown varying degrees of control. Complications, of course, may be expected in attempting to carry over laboratory findings into the field. Weather conditions could be most important.

From the following preliminary data we do have an indication that glycerol does enhance the absorption of streptomycin under outdoor field conditions as well as in the greenhouse.

Tomato plants and young Bartlett pear trees were sprayed to heavy run-off with the following combinations and leaf samples were collected after three days, washed and assayed:

<u>treatment</u>	<u>tomato</u> <u>mcg. /ml.</u>	<u>pear</u> <u>mcg. /ml.</u>
200 ppm streptomycin	11.7	12.9
200 ppm streptomycin + 1% glycerol	27	24
400 ppm streptomycin	— 26	21.5

The weather was extremely hot and sunny during this experiment. Some departure from the spraying technique used in greenhouse experiments was required. In the greenhouse leaves were sprayed carefully only on the top until incipient run-off. On the large plants in the field spraying to heavy run-off was necessary to be sure uniform coverage was attained. Perhaps this practice in addition to the very hot weather helped to raise streptomycin levels in the plants treated with streptomycin alone. From greenhouse data we should have expected lower levels here and resulting greater ratios of glycerol combination assays to assays corresponding to streptomycin alone. Under commercial conditions, however, the gallonage per plant would certainly be much less than on hand-sprayed field plots and type of coverage might more nearly resemble our greenhouse situation. In previous assays of tomato leaves from fields sprayed with streptomycin alone using commercial sprayers, we found much lower levels in the leaf juice.

Discovery of the glycerol effect has raised many more questions than we can immediately answer. The mechanism of enhanced absorption is not really satisfactorily explained in spite of certain theories. Also, we do not know histologically how the absorbed streptomycin is distributed. Accessibility of this absorbed streptomycin to infection counts may be critical for control of particular diseases. Certain other "penetrants" such as a mixture of methyl cellosolve and carbowax have been reported by Goodman and others to increase the effectiveness of antibiotics against fire blight. This "penetrant" has not given any enhancement in streptomycin absorption detectable by our assay in any of the plants Dr. Gray has studied. Perhaps, the methyl cellosolve-carbowax penetrant works against fire blight by a different mechanism or perhaps apple tissues may respond entirely differently than those of our plants.

Despite the unanswered questions and experimental work yet to be done it seems likely that the glycerol effect will provide a valuable tool for investigating the extent to which a "locally systemic action" can be brought to bear against stubborn infections at present only controllable with difficulty by streptomycin.

MERCK & CO., INC., RAHWAY, NEW JERSEY

CHEMOTHERAPEUTIC CONTROL OF CARNATION WILT

William Broce, D. F. Millikan and J. E. Smith, Jr.

Wilt of carnation caused by the fungus, *Fusarium oxysporum* f. *dianthi*, is a major disease affecting this important greenhouse crop. At the present time it has not been feasible to initiate an indexing program to insure the production of certified cuttings and therefore we have been exploring other means of control. One alternative, the use of certain systemic fungicides, seems to be quite promising and presently we are using four chemicals: HD 160 (Rohm and Haas), 1182 (Carbon Carbide), 522 (Monsanto), and 6462 (Monsanto). The first two were found to be effective by the Connecticut Station while the latter two have been experimentally tested only on tomato.

Cuttings of carnations are stuck in sand until well rooted and then transplanted into crocks filled with sterilized sand. Prior to planting the cuttings are soaked overnight in various concentrations of the chemicals used for 12 hours. Shortly after planting, actively growing bud cultures of *Fusaria* are poured on the sand to provide adequate inoculum. The plants are fed nutrient solutions twice a week and given periodic treatment with chemicals being tested. This work is just getting under way and tests to date have been limited to phytotoxicity studies. Thus we can only report that concentrations over 200 ppm with the Monsanto chemicals are phytotoxic and therefore their ultimate value in disease control must be with this or lower concentrations.

UNIVERSITY OF MISSOURI, COLUMBIA

THE USE OF ANTIMETABOLITES TO CONTROL STONE FRUIT VIRUSES

D. F. Millikan and H. W. Guengerich

In our stone fruit virus program we have relied solely upon eradication to control necrotic ring spot and sour cherry yellows. Although this method has proven satisfactory so far, as we extend our indicator host range we find additional infection that was not detected using the previous hosts. This has not been serious to date for we have always found clones of all major varieties that appear to be virus-free. Nevertheless, we have been forced to discard many promising selections possessing superior horticultural characters because of virus infection.

The results of tests using purine and pyrimidine analogues, appropriately termed antimetabolites, offer unique and interesting possibilities. Not only have many of these products been tested *in vitro*, but two of them, 8-azoguanine and thiouracil, have shown promise *in vivo*. Investigations using these two chemicals alone or in combination were set up in 1954 to see whether it might be possible to eliminate infection from buds in a desirable plum that has not been introduced because of virus infection. Treatment was started as soon as the tree leafed out and continued until terminal growth ceased at which time the sticks were removed for propagation.

Growth in 1955 of trees developing from the inserted buds was unusually vigorous and appeared to be free from the mottle for about 2 months, after which time the trees appeared to enter a shock and the mottling appeared. Buds from the trees were placed into Shiro-fugen to determine whether ring spot infection had been arrested in any of the meristematic tissue during the previous season. Four trees out of 60 appear to be free from ring spot as indicated with the Shiro-fugen indicator host. Two trees developed from buds treated with thiouracil and two from buds treated with 8-azoguanine.

It appears that there is some ameliorating affect due to the antimetabolites. However, the period of protection is apparently insufficient to obtain completely virus-free budwood. While we apparently did not obtain any synergistic affect using both chemicals, this principle will be exploited further using other metabolite blocking.

UNIVERSITY OF MISSOURI, COLUMBIA

PRELIMINARY TRIALS WITH ACTI-DIONE AGAINST POWDERY MILDEW ON ROSES, CEDAR RUST ON APPLES, AND DOWNY MILDEW ON GRAPES

H. G. Swartwout

From exploratory trials with Acti-dione in 1954 it was found that concentrations as low as 1 and 2 ppm effectively eradicated powdery mildew (*Sphaerotheca*) on the leaves and buds of roses and arrested the development of cedar rust (*Gymnosporangium*) lesions on apple leaves when the sprays were applied after rust lesions had become visible. Tests were expanded in 1955 to determine phytotoxicity hazards and the effectiveness of lower dosages.

Acti-dione when used alone was found to be injurious to an undesirable extent on some varieties of greenhouse roses at concentrations as low as 0.4 ppm, with indications that some injury may occur under certain conditions at dosages as low as 0.1 and 0.2 ppm. Injury was confined to the very young leaves and was evident within two days after the sprays were applied. By using Triton B1956 at 8 ozs. to 100 gals. and a pressure of 250 lbs. to give a good spreading of the spray on the young leaves, injury from Acti-dione at 0.5 ppm was reduced to a very low level on the sensitive variety, Pink Bountiful.

In field trials in 1955 on Dorothy Perkins, two applications of Acti-dione at 0.5 ppm with both 2 ozs. and 8 ozs. of Triton in 100 gallons almost completely removed the growth of powdery mildew on the leaves and flower buds. Lower concentrations than 0.5 ppm were not tried.

On apples 2 applications of Acti-dione at 1 ppm with 1 oz. of Triton B1956 stopped the development of cedar rust lesions on the leaves when the first spray was applied as soon as rust spots were visible. There was, however, an undesirable though not severe black spotting of the foliage and a moderate amount of black spotting on the under sides of the fruit.

As a possible way of reducing injury, tests were set up later in the season, using Acti-dione as low as 0.5 ppm and using increased quantities of spreader. In these tests injury has been negligible with Acti-dione at 0.5 ppm plus 2 ozs. of Triton. The effect of this dosage of Acti-dione in arresting the development of the cedar rust lesions, however, is uncertain at this date (July 8).

In tests on grapes in 1954 it was found that the Concord variety was reasonably tolerant of Acti-dione at 1 ppm but moderately to severely damaged at higher concentrations. Based upon these results, Acti-dione was applied to the very downy mildew susceptible variety Thomas, at 1) 1 ppm plus 3 ozs. Triton B1956, and 2) at 1 ppm plus 1 lb. captan plus 3 ozs. of Triton in 100 gallons. Both treatments almost completely stopped the development of downy mildew (*Plasmopara viticola*) as compared with a moderate spread of the disease on the unsprayed controls. UNIVERSITY OF MISSOURI, COLUMBIA (Paper presented by D. F. Millikan since Professor Swartwout was unable to attend the meeting).

SYSTEMICS AND TOXICOLOGY

William H. Brandt and Ralph W. Althaus

Before a chemical may be marketed as a plant protectant, it must be demonstrated to be safe when fed to laboratory animals at certain concentrations. Such a product is supposed to be restricted to plant surfaces where it remains relatively unchanged. As a further safeguard, edible portions of plants sprayed with such materials are usually washed prior to sale.

However, it is apparent that systemics cannot be deemed safe for use on human food by similar procedures. Being within the plant tissue, they cannot be washed off. Further, they are subject to metabolic alteration for the same reason. Evidence that such metabolic alteration actually takes place has been presented. Streptomycin is effective against blue mold (*Peronospora tabacina*) of tobacco when sprayed on tobacco plants but has no effect *in vitro*. Several speakers at this forum have stated that they have found many other systemically effective chemicals which are not active *in vitro*. In addition, either the systemic or its metabolic derivatives may accumulate if more than one spraying is necessary.

It seems clear, therefore, that many derivatives of a systemic chemical may be present in the edible portions of a plant, any of which may be toxic to humans. The problem then seems to be the establishment of safe concentrations of an unknown number of compounds of unknown structure. However, there is at least one other solution.

It has been said that more exhaustive toxicity tests are made on drugs for animal use than on drugs for human use. This is due to the fact that only a tolerance level for the drug must be established in the case of human drugs whereas both a tolerance level for the drug and tests for fitness for human consumption of the meat from drugged animals must be carried out in the case of animal drugs. Similar tests could be made with systemics and edible portions of plants treated with systemics.

It is conceivable that some so-called protectants are systemic or partially systemic in their action. Dr. Brandes indicated earlier in this forum that Dithane may act systemically although the identity of the systemic agent is not clear. Any protectants which are shown to be systemic will obviously have to be subject to the same sort of testing as any other systemic.

Establishing tolerances for systemics is a more complicated process than establishing tolerances for protectants. Let us exercise proportionately more caution in the introduction of chemicals.

METHODS IN EVALUATING SYSTEMIC FUNGICIDES

John B. Harry

Chemicals can be evaluated for systemic fungitoxic activity in four ways:

1. Seed treatment
2. Soil treatment
3. Injection of plant parts
4. Surface application to aerial plant parts.

Our laboratories use all except 3). For disease control in any plant stage beyond the seedling, seed treatment 1) is perhaps the least promising of immediate success since the dilution factors of penetration, growth of the host, and time are so great. Soil treatment 2) interposes a barrier between the chemical and absorption by the host that is both highly reactive and highly absorptive; this is a largely impractical method of getting chemicals into the tops of plants, but it may have some value in the control of root and vascular diseases. The anatomy of plants and the cumbersomeness of injection 3) make this method of academic interest only. Of most promise, therefore, is surface treatment 4). Contrary to textbook dicta, an amazing number of chemicals will penetrate leaves and this can be controlled to some extent by attaching the fungitoxic moiety to a penetrative moiety in the molecule. Unless some distinctive change is produced in the plant, as by Experimental Chemotherapeutant 1182 (4-chloro-3,5-dimethyl phenoxyethanol), or unless the chemical can be estimated by conventional analytical or biological methods, its path of translocation must be measured by using radioactive tracer techniques. In applying chemicals as surface treatments, the experimenter must carefully distinguish between simple exterior protection or eradication and true systemic fungitoxicity. This is best done by applying the chemical to part of the plant and observing the disease control effected on the untreated part of the plant.

CARBIDE & CARBON CHEMICALS COMPANY

FUNGICIDES AND OAK WILT

W. H. Bragonier

Diseases of plants in which the vascular systems are affected, directly or indirectly, challenge pathologists to find fungicides which, when absorbed by roots or leaves, prevent infection or enable plants to recover after infection. So little is known about the chemical and physical bases of parasitism that the search has been and will continue to be largely empirical until the enzyme systems and respiratory mechanisms of host and parasite are better understood.

Attempts to find chemicals effective against the oak wilt pathogen, *Endoconidiophora fagacearum* Bretz, were begun in 1947 at Iowa State College and are being continued. More than 100 fungicide formulations, including representatives from the organic sulfurs, quaternary ammoniums, inorganic and organic metals, and basic dyes, have been tested in the laboratory, greenhouse, and field (Hoffman, 1951; Murphy, 1954). Applications to root zones, tree trunks, and foliage have failed to reveal any effective materials. Promising leads are being followed, but until more is known about the behavior of the pathogen within the host, there is little hope one will be found.

In 1953, five fungicides¹ (CP 4370, nabam, Vancide 51, BTC 471, and Vancide 41) selected as most promising from earlier tests (Hoffman, 1951) were used to treat the root zones of 5-year-old pin oak trees in an experiment involving 450 trees in each of four replications (Murphy 1954). Chemicals at rates of 0, 500, and 2500 ppm were applied 10 days before and 10 days after inoculation with the oak wilt pathogen. Ten trees were treated at each rate and each time; a treated uninoculated check plot was established for each of the three rates (0, 500, 2500 ppm).

¹ CP 4370 -- experimental chemical supplied by Monsanto Chemical Company. Nabam -- Dithane D-14, disodium ethylenebis dithiocarbamate. Vancide 51 -- sodium dimethyldithiocarbamate; sodium derivative of 2-mercaptobenzothiazole. BTC 471 -- alkyl dimethylethylbenzylammonium chloride, Vancide 41 -- sodium 2-mercaptobenzothiazole.

Estimations of the percentage of the crown showing oak wilt symptoms were recorded and the growth increment for 1953 was determined for each tree.

Analysis of the data from this experiment revealed no significant differences between chemicals, rates, and times. A separate analysis of the growth increments of the chemically treated, uninoculated check trees revealed significant linear and quadratic effects which were interpreted as indicating phytotoxicity at the highest dosage. Repetition of the experiment with rates intermediate between 500 and 2500 ppm would be necessary before conclusions could be drawn about the relative effectiveness of the various chemicals in delaying or preventing the growth rate reductions caused by the pathogen. Since nearly all of the inoculated, untreated check trees died and a few of the treated trees were still alive in 1955, some hope remains that a fungicide may yet be found which will prevent or cure the disease in young trees. Whether such, if found, would protect a large tree remains to be determined. Many factors difficult to control are involved in this type of research.

Information is needed about the enzyme systems of the pathogen and host and their complex interactions, some of which result in death of the host. If these relationships were understood, and if fungicides with labeled atoms and the ability to block one or more enzyme systems were available, research workers would be closer to finding a solution to the oak wilt problem and other similar problems than they are now.

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THE PLANT DISEASE REPORTER

Issued By

PLANT DISEASE EPIDEMICS
and
IDENTIFICATION SECTION

AGRICULTURAL RESEARCH SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

SOME NEW AND IMPORTANT PLANT DISEASE OCCURRENCES
AND DEVELOPMENTS IN THE UNITED STATES IN 1954

Supplement 235

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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

Horticultural Crops Research Branch

Plant Industry Station, Beltsville, Maryland

SOME NEW AND IMPORTANT PLANT DISEASE OCCURRENCES
AND DEVELOPMENTS IN THE UNITED STATES IN 1954

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Some 1953 reports on plant diseases are included in this summary which were not published when the 1953 summary was completed. Otherwise this summary includes important diseases of 1954 compiled for the most part from reports to the Plant Disease Epidemics and Identification Section and articles in Phytopathology. Reports listed in the tables are not usually noted again in the text.

WEATHER OF 1954. General Summary. -- The year 1954, among the driest and warmest on record, was notable for drought and destructive storms. Drought and record-breaking heat, prevailing over the southern half of the Country during the critical growing season, seriously damaged crops and reduced streamflow to a minimum of record. Hurricanes, moving up the Atlantic Coast in August, September, and October, were responsible for the major portion of the year's storm damage which totaled nearly \$900,000,000.

Temperature and precipitation, however, furnished little basis for complaint in most sections of the Pacific States and the northern half of the Nation, although a number of localities in the latter area were seriously affected by destructive storms. Timely rains provided ample moisture for above average crop production and periods of uncomfortable heat were usually short. In the North Central Interior mild weather in January and February favored livestock and reduced fuel costs. The Pacific States enjoyed one of the coolest summers on record.

Some other unusual weather features occurring during the year were: New national low temperature record of -69.7° at Rogers Pass, Mont., on January 20, the mildest February on record in the North Central Interior, the hottest summer on record in parts of the South, dust-storms reminiscent of the 1930's in the western portions of the lower Great Plains in February and March, the highest flood in the Rio Grande River in history in June (caused by heavy rains which fell during the passage of hurricane Alice), the heaviest snowfall since February 1899 in parts of the east Gulf region during March, a record number of tornadoes for a single year, damaging floods in New England during May and in Iowa during June, a record-breaking heat wave in the central Mississippi Valley during June and again in July, and unprecedented rains in California during August.

DROUGHT. -- In the western portions of the lower Great Plains drought persisted through the third straight year. In February and March duststorms contributed to the damage of small grains and pastures. In the latter month losses from wind and dust in Colorado alone amounted to \$5,000,000. April rains brought relief to Texas and Oklahoma and were helpful in some other sections. Spotted rains during May and the summer months were of very limited benefit after mid-June owing to the intense heat and dry soil. The autumn was very dry, but many sections received helpful rains in December.

The drought in the Southeast, centered in northern Florida and southern portions of Georgia and Alabama, developed during the first 3 months with less than 25 percent of normal rainfall in January and less than 50 percent in February and March. Continued below-normal rainfall combined with intense heat from mid-June to mid-October damaged crops severely. A few early crops were a complete loss, and total crop production in South Carolina was the least in 50 years.

Drought spread over the entire South in June and continued through the summer and fall. Crops suffered, soil moisture was depleted, and streamflow dwindled to or near the minimum of record. Some municipal water supplies became so low that rationing was necessary. December rains replenished surface moisture in many sections, but subsoil moisture generally remained depleted.

PRECIPITATION. -- The year's precipitation was below normal over approximately two-thirds of the Country. Much of the South, the western and lower portions of the Great Plains, and the central part of the Great Basin of the far West had less than 75 percent of normal and some sections in these areas had less than 50 percent. In South Carolina, northern Florida, and

southern portions of Alabama and Georgia the year was the driest on record. For the period June through September Spartanburg, S. C., had a total of only 3.76 inches which was 12.31 inches below normal. The yearly total of 28.66 inches at the Weather Bureau Office in Pensacola, Fla., represented a deficiency of 32.94 inches or only 47 percent of normal. In parts of the Southeast heat and drought cut early crops 50 percent or more.

Precipitation was above normal in regions near the Canadian Border, along the West Coast, in scattered sections of the far Southwest, and in the southern portion of the Florida Peninsula. In most of these areas precipitation fell at timely intervals throughout the year.

Snowfall was below normal in most areas where snow is a common occurrence. Heavy falls were relatively fewer and less extensive than is normally the case, thereby causing little interference to transportation. The cover, however, was generally adequate to protect winter grains and pastures from severe freezes, particularly the one on January 20-21 when 40-below-zero-minima occurred in several sections of the North Central Interior.

TEMPERATURE. -- Average temperatures for 1954 were normal or slightly below in Pacific coastal areas from Santa Maria, Calif., to the State of Washington and thence eastward along the Canadian Border to the Continental Divide, in the Florida Peninsula, and a few other small scattered localities in the Atlantic Coastal States, and above normal elsewhere. Plus anomalies exceeded 2° in much of the central and lower Rocky Mountain State area, the central and lower Great Plains, and the central Mississippi Valley.

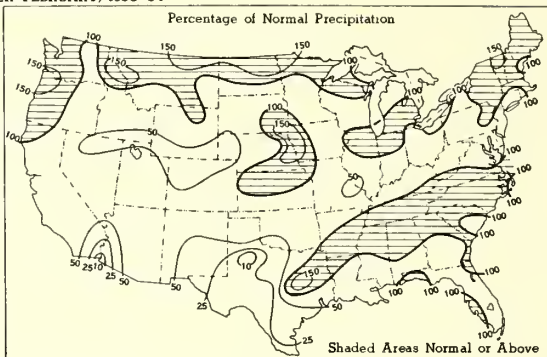
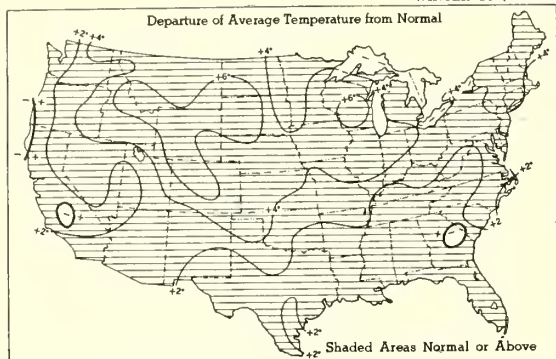
January, February and April were mild months, while March and May were rather cold. In the southern two-thirds of the Country a period of unusually hot weather began at mid-June and persisted until mid-October. Numerous all-time-high temperatures occurred in the area in June and July and many seasonal records in August, September, and October. The number of days with maxima above 100° also set new records at many stations. Following a break in the heat wave in mid-October temperatures followed a more nearly normal pattern during the remainder of the year.

DESTRUCTIVE STORMS. -- During 1954 hurricanes accounted for 193 deaths and \$755,472,500 damage, tornadoes 35 deaths and \$28,367,400 damage, other windstorms 99 deaths and \$30,700,900 damage, and hailstorms \$72,695,600 damage - a total of 327 deaths and \$887,236,400 damage to property and crops. The dollar value of losses for both hurricanes and hail set new annual records. (From Climatological Data. National Summary, Annual 1954, Vol. 5. No. 13).

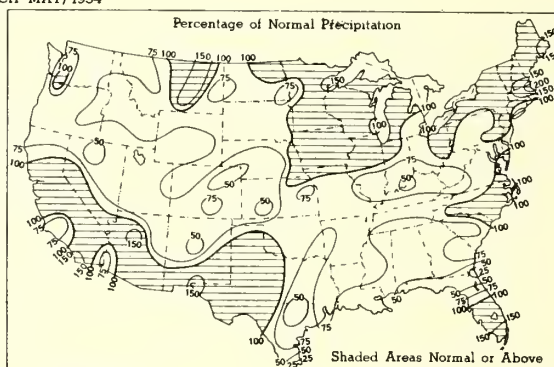
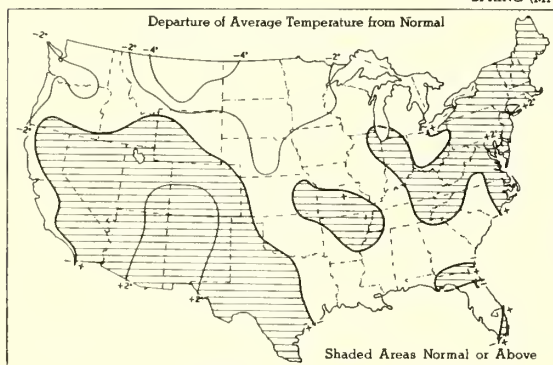
The Maps on pages 138 and 139 show the temperature and precipitation for the winter of 1953-54, spring, summer, and fall of 1954.

TEMPERATURE AND PRECIPITATION

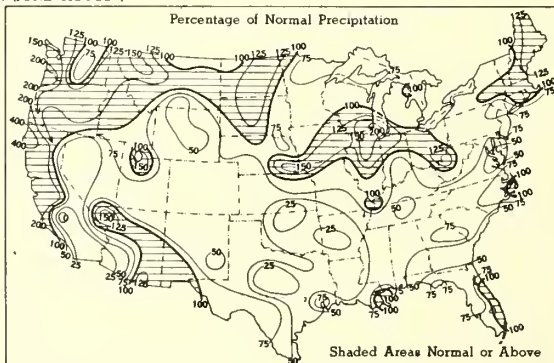
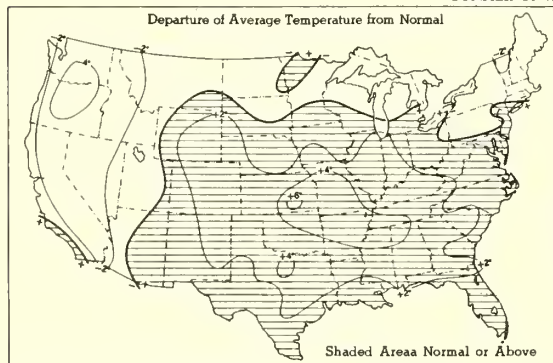
• WINTER OF (DECEMBER-FEBRUARY) 1953-54



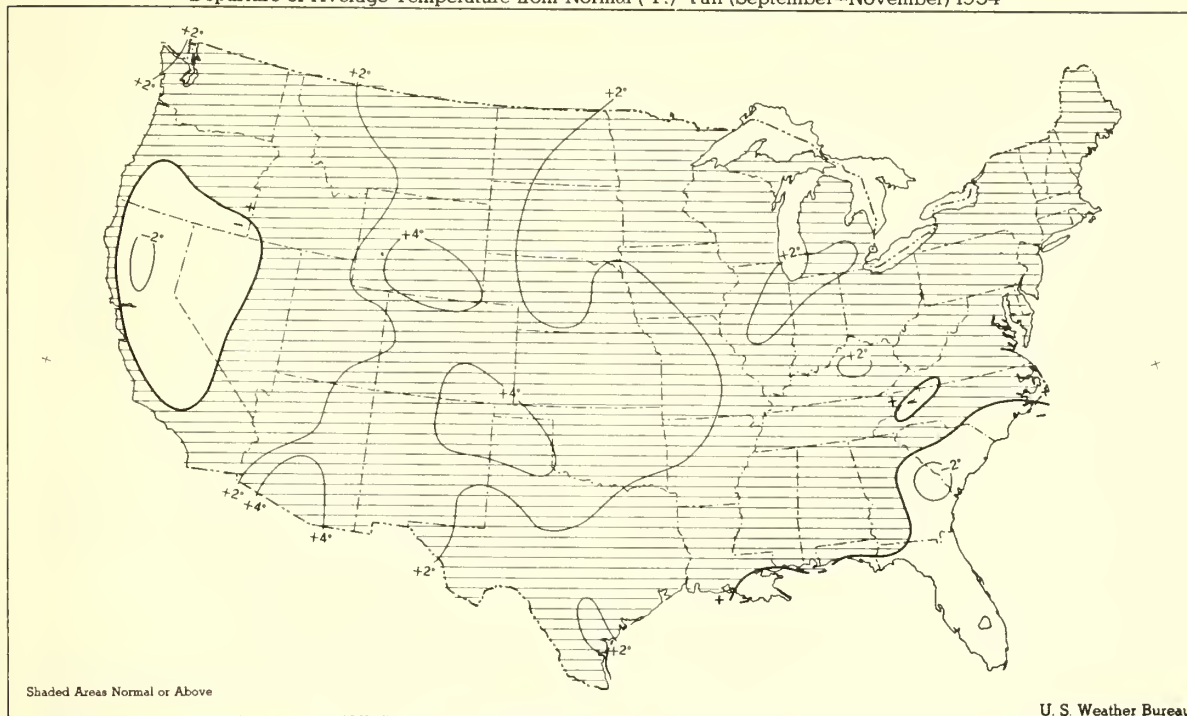
SPRING (MARCH-MAY) 1954



SUMMER OF 1954 (JUNE-AUGUST)

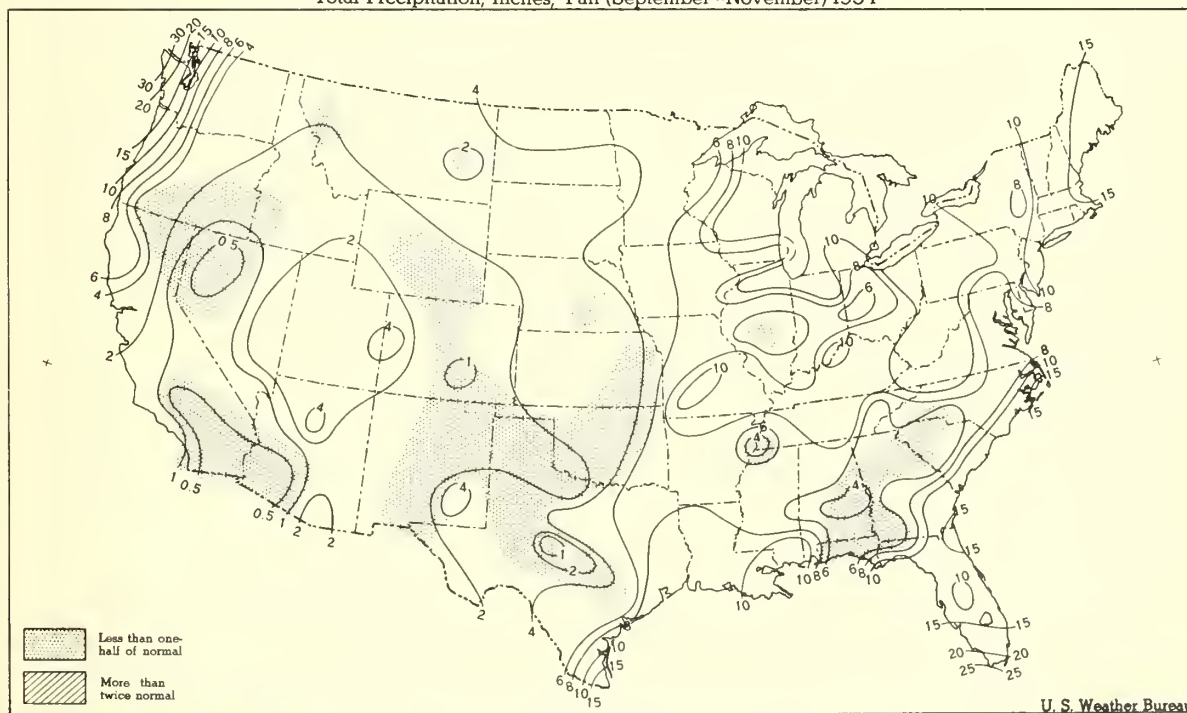


Departure of Average Temperature from Normal (°F.) Fall (September–November) 1954



Based on preliminary telegraphic reports

Total Precipitation, Inches, Fall (September–November) 1954



Based on preliminary telegraphic reports

(From Weekly Weather and Crop Bulletin National Summary, Volume 41, 1954)

Table 1. Diseases reported in States where they had not been found or reported on a particular host until 1954^{1, 2}.

Host Disease (Cause)	Where found	Remarks
BARLEY (HORDEUM VULGARE) <u>Ascochyta hordei</u>	West Virginia	Occurs commonly, though probably causes little injury. Most evident in early spring. Sprague records this fungus only from the Western States. (PDR 39: 332)
RYE (SECALE CEREALE) Dwarf bunt (<u>Tilletia caries</u>)	Oregon	Dwarf bunt was found in Oregon in 1953 and 1954. (PDR 39: 685)
WHEAT (TRITICUM AESTIVUM) Cercospora foot rot (<u>Cercospora herpotrichoides</u>)	New York	Collected in Tompkins County, June 1, 1953. The disease was found in 25 counties during a survey in May, June and July, 1954. (PDR 38: 710)
Twist (<u>Dilophospora alopecuri</u>)	Georgia	Observed in a 10-acre field of Chancellor in Hart County. March 16. The stand was ruined and subsequently plowed up. (PDR 39: 17)
Wheat streak mosaic (virus)	Washington	Not previously reported from the Pacific Northwest, caused severe infection in 1954. (PDR 38: 714)
ALFALFA (MEDICAGO SATIVA) Leptosphaeria leaf spot (<u>L. pratensis</u>)	Iowa	One of the most important diseases in Iowa in 1954. (PDR 39: 239)
AUSTRIAN WINTER PEA (PISUM SATIVUM var. ARVENSE) Leaf and pod spot (<u>Cercospora lathyrina</u>)	Mississippi	The disease was found at the Coastal Plain Branch Experiment Station near Newton on February 17, 1954. (PDR 38: 781)

¹ W. W. Ray. Unusual or new occurrences of fungus pathogens on grasses in Nebraska. PDR 38: 583. He stated that in the process of identifying these fungi some apparently rare or new occurrences of fungi in the State, or unreported host relationships, were discovered.

² Muller, Albert S., Anna E. Jenkins, and A. A. Bitancourt. Elsinoë and Sphaceloma in Florida. PDR 38: 599. Collections of Elsinoë and Sphaceloma in Florida, 1952-53, supplemented by several earlier specimens from Florida, hitherto unreported, are tabulated.

Table 1. (Continued).

Host Disease (Cause)	Where found	Remarks
PECAN (HICORIA ILLINOENSIS) Bunch disease (Virus)	New Mexico	Trees known to be affected with bunch disease have been observed in Mississippi, Louisiana, Arkansas, Texas, and Oklahoma. The soil on which the trees were grown in New Mexico had a pH of 8.5.
PEACH (PRUNUS PERSICA) Fruit rot (<i>Diplodia natalensis</i>)	South Carolina	In July 1953, <i>Diplodia</i> was isolated from mature peaches grown in the vicinity of Inman, South Carolina. (Phytopath. 44: 471)
STRAWBERRY (FRAGARIA SPP.) Fruit rot (<i>Gnomonia fructicola</i>)	Maine	Found in early July in a Maine plantation. (PDR 38: 796)
SWEET CHERRY (PRUNUS AVIUM) Rasp leaf (Virus)	New Mexico	The infected trees were found in a 20-year-old orchard at Mountain Park. Eight localized trees in a 200-tree orchard were found to be infected. (PDR 38: 832)
RED BUD (CERCIS CANADENSIS) Dieback (<i>Botryosphaeria ribis</i> <i>var. chromogena</i>)	West Virginia	This pathogen occurs commonly in some areas and limits the use of this tree in landscaping. (PDR 39: 333)
CYCLAMEN (C. PERSICUM) Root rot (<i>Thielaviopsis basicola</i>)	Maryland	A severe case of cyclamen root rot was found in a greenhouse in Baltimore County. (PDR 38: 354)

Table 1. (Continued)

Host Disease (Cause)	Where found	Remarks
FLOWERING DOGWOOD (CORNUS FLORIDA) Anthracnose (<u>Elsinoë corni</u>)	West Virginia	Found in Wayne County. (PDR 39: 333)
GLADIOLUS <u>Curvularia lunata</u>	California	Found in San Diego and Alameda Counties. Took the form of a neck rot of cormel stock. Combination of high temperature and high humidity favored the disease. (PDR 38: 796)
Western aster yellows (Virus)	Kansas	In July 1954, a grower in Kansas sent 62 corms to the Plant Industry Station reporting that similar stock produced only thin multiple sprouts or failed to grow. This is the second record known to the writers of commercial loss from aster yellows in gladiolus and the first record of such loss in Kansas. (PDR 38: 739)
PEONY (PAEONIA OFFICINALIS) Stem and leaf spot (<u>Gloeosporium</u> sp.)	West Virginia	Probably the same <u>Gloeosporium</u> anthracnose that has been found in several of the eastern States. (PDR 39: 333)
LIPPPIA CANESCENS <u>Meliola</u> sp.	Arizona	In 1953 a large <u>Lippia</u> planting near Phoenix was practically killed by this fungus which invaded the stems and leaves of the plants, causing conspicuous black blotches. (PDR 39: 425)
Southern blight (<u>Sclerotium rolfsii</u>)	Arizona	Until the summer of 1954, the disease had not been observed in Arizona. A large planting near Phoenix was found infected. (PDR 39: 425)

Table 1. (Continued)

Host Disease (Cause)	Where found	Remarks
GOATHEAD (TRIBULUS TERRESTRIS) COCKLEBUR (XANTHIUM COMMUNE) COPPER MALLOW (SPHAERALCEA ANGUSTIFOLIA) Verticillium wilt (<u>V. albo-atrum</u>)	New Mexico	Weed hosts not previously reported. (PDR 38: 894)
CANTALOUPE (CUCUMIS MELO) Fusarium wilt (<u>F. oxysporum</u> f. <u>melonis</u>)	North Carolina	In the summer of 1953 wilting cantaloupe plants were observed scattered throughout a 2-acre field in Warren County. (PDR 39: 334)

Table 2. Diseases found or reported in this country for the first time in 1954=*; diseases found on new hosts=**, ¹.

Host Disease (Cause)	Where found	Remarks
RICE (ORYZA SATIVA) <u>Radopholus oryzae</u> **	Texas Louisiana	Found near Beaumont, Texas and seven locations in south-western Louisiana. It has been reported to damage rice roots in certain Asiatic areas. (PDR 39: 69)
STRAWBERRY (FRAGARIA SPP.) New disease (resembling aster yellow virus disease)	Arkansas	The disease was almost universally present in strawberry plantings in Arkansas in May of 1954, affecting 20 percent of the plants in some fields. (PDR 38: 630)

¹ John R. Hardison. New grass host records and life history observations of dwarf bunt in eastern Oregon. (PDR 38: 345).

Table 2. (Continued)

Host Disease (Cause)	Where found	Remarks
RED CLOVER (TRIFOLIUM PRATENSE) Curvularia leaf spot* (<u>Curvularia trifolii</u>)	Maryland Florida	Not previously reported in the United States, has been observed since 1950, occasionally damaging red clover in Maryland and Florida. (PDR 39: 181)
CROTALARIA SPECTABILIS LUPINUS DENSIFLORUS MEDICAGO LUPULINA TRIFOLIUM HYBRIDUM VICIA VILLOSA Yellow bean mosaic** (Bean virus 2)	Idaho	Artificial inoculation was made with the virus from infected sweet clover plants. (PDR 38: 621)
LOTUS ULIGINOSUS Leaf spot** (<u>Cercospora loti</u>)	Maryland Georgia	Fungus reported previously only from Hungary. Hitherto not reported on this host, found at Beltsville, Md. and near Alapha, Ga., in 1954. (PDR 39: 236)
SOYBEAN (GLYCINE MAX) <u>Heterodera glycines</u> *	North Carolina	This cyst-forming nematode has been reported from Japan and China. (PDR 39: 9)
AGROPYTON CRISTATUM A. DESERTORUM A. SIBIRICUM Dwarf bunt (<u>Tilletia caries</u>)	Idaho Oregon	Found in nursery plantings. First report of disease on <u>A. cristatum</u> in North America. <u>A. desertorum</u> and <u>A. sibiricum</u> reported as new hosts. The latter reported only from Idaho. (PDR 39: 685)
ORCHARD GRASS (DACTYLIS GLOMERATA) Dwarf bunt** (<u>Tilletia caries</u>)	Oregon	Found in eastern Oregon test nursery in July 1954. (PDR 39: 685)

Table 2. (Continued)

Host Disease (Cause)	Where found	Remarks
CENTIPEDE GRASS (EREMOCHLOA OPHIUROIDES) Blast* (<u>Piricularia oryzae</u>)	Florida	Isolated from lesions on leaves in Alachua County and Leon County. First rept. on this host in United States. (PDR 38: 796)
MEADOW FOXTAIL (ALOPECURUS PRATENSIS) Leaf spot* (<u>Mastigosporium album</u>)	New York	Observed in June 1954 on meadow foxtail growing near Ithaca. Reported on this host in Wales and England, central Europe Scandinavia, Russia and Britain. (PDR 38: 607)
PEARL MILLET (PENNISETUM GLAUCUM) Rust* (<u>Puccinia penniseti</u>)	Georgia	Although <u>P. penniseti</u> has not previously been reported in the United States, <u>P. cenchri</u> which has been reported on <u>Pennisetum multiflorum</u> seemed to be a closely related species. (PDR 38: 511)
TIMOTHY (PHLEUM PRATENSE) <u>Helminthosporium dictyoides</u> var. <u>phlei</u> , J. H. Graham	Pennsylvania and other northern States	J. H. Graham. (Phytopath. 45: 227)
CHRYSANTHEMUM Ringspot** (Virus)	Alabama	A newly recognized pathogen found in combination with chrysanthemum stunt virus. (PDR 39: 33)
CINERARIA (SENECIO CRUENTUS) Chlorosis and dieback** (<u>Thielaviopsis basicola</u>)	Maryland	Found in the University of Maryland greenhouses. (PDR 38: 354)

Table 2. (Continued).

Host Disease (Cause)	Where found	Remarks
GERBERA (G. JAMESONII) Chlorosis and dieback** (<u>Thielaviopsis basicola</u>)	Maryland	Found in the University of Maryland greenhouses. (PDR 38: 354)
HOLLY (ILEX AQUIFOLIUM) Phytophthora leaf and twig blight (<u>Phytophthora</u> sp.)	Oregon Washington	A new Phytophthora disease known for many years but not previously described. This disease is of major importance in Oregon. The pathogen is a new species of <u>Phytophthora</u> related to the <u>P. syringae</u> group. (PDR 38: 723)
CHINESE HOLLY (ILEX CORNUTA) Spot anthracnose (<u>Sphaceloma</u> sp.)	Louisiana	A new disease of holly. The trees on which the disease was first observed were grown from seed that came from a tree in Baton Rouge. Although the disease was later found in this tree, it seems unlikely that the disease was transmitted by means of seed. (PDR 39: 243)
HYDRANGEA (H. MACROPHYLLA) Aster yellows** (Virus)	Oregon	A single plant of the florist's hydrangea var. Charm was received from Oregon in May 1954. This is believed to be the first record of aster yellows in hydrangea or in the family Saxifragaceae. (PDR 38: 739)
JASMINE (JASMINUM SPP.) Galls (<u>Phoma</u> sp. probably a new sp.)	Texas	Fungus galls were readily induced on winter jasmine, on large-leaved privet and on small-leaved jasmine, by wounding and spray inoculation. (PDR 38: 564)

Table 2. (Continued)

Host Disease (Cause)	Where found	Remarks
LIPPIA CANESCENS Crown gall** (<u>Agrobacterium tumefaciens</u>)	Arizona	Since the first specimens were found in June, 1953, the disease has been found in 3 plantings near Phoenix and one near Tucson. (PDR 39: 425)
NARICISSUS SP. Bacterial streak	Washington	An unusual collapse of Naricissus stems was observed in a commercial field in the spring of 1954. About 2 percent of the plants were infected in a stock that had not been dug for 2 years. (Phytopath. 44: 489)
PANSY (VIOLA TRICOLOR) Aster yellows** (Virus)	Maryland	Found on the grounds of the Plant Industry Station at Beltsville. This is believed to be the first record of occurrence of this virus in pansy or in the family Violaceae. (PDR 38: 739)
PICK-A-BACK (TOLMIEA MENZIESII) Powdery mildew** <u>Sphaerotheca</u> sp.	Oregon	All of 100 plants in one Portland greenhouse were found to have their older leaves covered with brown perithecia of a powdery mildew. Seemed to fall within the range of <u>S. mors-uvae</u> . (PDR 39: 334)
SALPIGLOSSIS SINUATA Powdery mildew** (<u>Erysiphe cichoracearum</u>)	Michigan	Species formerly used extensively as a garden ornamental. Experimental material obtained from Univ. Michigan. (PDR 38: 563)
SCINDAPSUS (<u>S. AUREUS</u>) Root rot* (<u>Thielaviopsis basicola</u>)	Maryland	From a greenhouse in Frederick, Maryland several specimens of scindapsus were received which had lost almost all roots due to rot. (PDR 38: 354)

Table 2. (Continued)

Host Disease (Cause)	Where found	Remarks
ZINNIA VERTICILLATA Z. PAUCIFLORA Powdery mildew** (<u>Erysiphe cichoracearum</u>)	Michigan	These two host species are not grown horticulturally in the United States. Seeds of these species were sent to this country from Sweden. (PDR 38: 563)
CASTORBEAN (RICINUS COMMUNIS) Stem gall disease** (<u>Synchytrium</u> sp.)	Texas	Observed on the variety Cimar-ron in a commercial nursery at Cameron. Main symptoms found on the stems, petioles and leaf blades of small seedling plants as small red galls. (PDR 38: 728)
Charcoal rot* (<u>Sclerotium bataticola</u>)	Texas Florida South Carolina Virginia Maryland	The organism compared favor-ably with previous descriptions of <u>S. bataticola</u> ssp. <u>typica</u> , and was infectious on bean, and se-same as well as castorbean. (PDR 39: 233)
AMERICAN ELM (ULMUS AMERICANA) Root rot** (<u>Thielaviopsis basicola</u>)	Maryland	The presence of <u>T. basicola</u> in 100 percent of the infected roots sampled was verified by isolating the organism on carrots. (Phytopath. 45: 55)
INDIA-HAWTHORN (RHAPHIOLEPIS INDICA) Leaf spot* (<u>Entomosporium maculatum</u>)	California	During the spring of 1954 this serious leaf spot disease was found in several nurseries in the San Francisco Bay area. (Phytopath. 45: 55)
YEDDO-HAWTHORN (RHAPHIOLEPIS UMBELLATA var. INTEGERRIMA) Leaf spot** (<u>Entomosporium maculatum</u>)	California	This host found to be much more resistant to the leaf spot than <u>R. indica</u> . (Phytopath. 45: 55)

Table 2. (Continued)

HOST Disease (Cause)	Where found	Remarks
RED MULBERRY (MORUS RUBRA) Twig blight and canker** (<u>Fusarium lateritium</u>)	Mississippi	Distribution as well as the means by which it spreads is not known. It has not been observed to kill trees. (PDR 39: 657)
SCOTCH LABURNUM (LABURNUM ALPINUM) Laburnum vein-mosaic (proposed name)	Maryland	Inoculations from leaves of <u>L. alpinum</u> produced reactions of a ringspot type in tobacco, cucum- ber, snapdragon and bean. The virus thus detected proved to be a mild strain of the tobacco ringspot virus, similar to mild strains common in gladiolus. Laburnum vein-mosaic is sug- gested for disease from which tobacco ringspot virus was iso- lated but no evidence is avail- able that this virus causes the Laburnum vein-mosaic. (PDR 38: 740)
RED ALDER (ALNUS GLUTINOSA) <u>Valsaria megalospora</u> *	Oregon	Found in 1952 in Clackamas County. This is a distinctive bark fungus. It has been found in Europe. (PDR 39: 334)
YELLOW-POPLAR (LIRIODENDRON TULIPIFERA) Dieback	Mississippi	Apparently a new disease found on the Tallahatchie Experimental Forest. An unidentified fungus has been consistently isolated. (PDR 38: 786)

Table 2. (Continued)

Host Disease (Cause)	Where found	Remarks
CARROT (DAUCUS CAROTA)		
Black mold** (<u>Thielaviopsis basicola</u>)	California	As a test carrots were shipped from Calif., to New York in polyethylene bags. The fungus was able to develop on this host because of the combination of high humidity within the bags and the high temperature at which they were stored. (PDR 38: 855)
ONION (ALLIUM CEPA)		
Mottled brown streaking (<u>Xanthomonas striaformans</u> Thomas & Weinhold)	Colórado	Since 1948 Sweet Spanish onions in the Arkansas Valley of Colorado have been affected by a mottled brown streaking of the older leaves and leaf sheaths which develop at temperatures exceeding 75° F. (Jour. Colo-Wyo., Acad. Sci. 4: 23, 1955)
TOMATO (LYCOPERSICON ESCULENTUM)		
Leaf spot (<u>Stemphylium floridanum</u> Hannon & Weber)	Florida	This fungus is similar to gray leaf spot caused by <u>S. solani</u> . Experiments indicate that the fungus is pathogenic on a number of tomato varieties, pepper, wild soda apple and possibly gladiolus. (Phytopath. 45: 11)
Puffball* (<u>Tylostoma berterioanum</u>)	Texas	Found on tomato seedlings growing in rotting cow manure. They matured and dispersed their spores in Sept., and Oct., Seemed to be a hot weather fungus. Common in Argentina. (PDR 39: 656)

DISEASES OF CEREAL CROPS

J. G. Moseman and others reported trends in disease losses of wheat, oats, and barley in North Carolina from 1950 to 1954. More than 800,000 acres of these cereals were harvested annually in North Carolina during the last decade. Wheat, oats and barley yielded 22, 37.5 and 34 bushels per acre, respectively, in 1954. The reduction in potential yield of these three grains in the State from various diseases was estimated for each of the last five growing seasons. Although the loss estimates may be somewhat inaccurate, the year to year trends for the various diseases were thought to be significant. (PDR 38: 887).

Occurrence and importance of small grain diseases in Georgia in 1953-54 was reported by J. H. Miller and others. (PDR 39: 17).

Notes on diseases of cereals and ornamentals recorded in West Virginia during 1953 and 1954 were reported by E. S. Elliott. (PDR 39: 332).

In Wisconsin, the effectiveness of certain antibiotics for the control of seed-borne diseases of small grains was reported by Leben and others. (Phytopath. 44: 704).

G. W. Bruehl and H. Toko reported a Washington strain of the cereal yellow dwarf virus. In California both the apple grain aphid (Rhopalosiphum fitchii) and the English grain aphid (Macrosiphum granarum) are efficient vectors. The apple grain aphid was also effective in Washington, but a single trial indicated that the English grain aphid may be a poor vector of the Washington strain. (PDR 39: 547).

Three virus diseases, wheat streak mosaic, barley false stripe, and barley yellow dwarf have been definitely established as affecting small grains in Wyoming. (PDR 38: 836).

AVENA SATIVA. OATS: Puccinia coronata avenae, crown rust. M. D. Simons reported that in investigations by the U. S. Department of Agriculture and Iowa Agricultural Experiment Station, Ames, using a new set of 10 differential oat varieties, 18 physiologic races of crown rust were identified among collections obtained in 1953 from the United States and Canada. Of these race 202 was predominant followed by races 203 and 213. Race 241 was more prevalent than in previous years. Ninety-one percent of the races attacked Bond, representing a decline in number, and 25 percent attacked Victoria. (PDR 38: 649). M. D. Simons and others reported methods used for reestablishing pure lines of some of the badly mixed differential oat varieties for identification of crown rust races. (PDR 39: 23)

Robert W. Earhart reported the effect of certain seed treatments on stand, yield and seedling blight in Sunland oats in the South. Increases in stand resulting from seed treatment ranged from 5 to 84 percent, with no significant advantage for either Ceresan M or Panogen. Increases in yield ranged from 7 percent at Gainesville to 133 percent at Tifton. All treatments increased emergence and seven of them significantly reduced infection by Helminthosporium. Pentrete, MEMA, Ceresan M, BB/LML/20, and Panogen, in the order named were most effective in the latter respect. (PDR 38: 760). Injury caused by seed treatment of wheat and oats and the gains from seed treatment was discussed by Koehler and Bever. (PDR 38: 762). M. D. Simons reported that two isolates of race 263 of crown rust of oats have been identified from material obtained from Manitoba, Canada. This race vigorously parasitized the varieties Landhafer, Sante Fe, Trisperina, and Bondvic. Ukraine and Victoria were resistant and offered possible sources of resistance. The Avena strigosa varieties, Saia and Glabrota, were highly resistant. (PDR 38: 505).

Puccinia graminis avenae, stem rust. Stem rust resistance in oats induced by nuclear radiation was reported by C. F. Konzak. (Jour. Agron. 46: 538).

Septoria avenae. In tests reported by M. D. Huffman, several oat selections proved to be more resistant than the common commercial varieties to S. avenae.

Seed treatment tests on oats for smut (Ustilago avenae and U. kolleri) 1953-54, see under Triticum aestivum, Tilletia.

Infection by oat smut (U. avenae and U. kolleri) at the different stations in Maryland, Virginia, Minnesota and Washington ranged from 8.1 to 29.2 percent in plants from untreated seed, and from 0 to 3.6 from treated seed. Out of 13 treatments, nine reduced the average infection to less than 0.6 percent. (R. W. Leukel, PDR 38: 755).

Blue dwarf and red leaf (virus). W. H. Sill and others reported that for several years blue dwarf and red leaf have been seen in Kansas oat fields. During the past four years the complex was more prevalent in 1951 and 1954. In 1954 it was present as scattered plants in most fields examined throughout the oat growing area and in a few fields possibly 5 percent or more of the plants were affected. In general losses have been slight but potentially this disease complex must be considered a threat to oat production in Kansas. (PDR 38: 695).

HORDEUM VULGARE. BARLEY: According to G. W. Bruehl early barleys yielded less and appeared to suffer more from root rot (Pythium arrhenomanes) than did adapted varieties of medium to late maturity. (Phytopath. 45: 97).

Ustilago nuda, loose smut, according to T. T. Hebert, can be effectively controlled by holding soaked seed in air-tight containers. The length of anaerobic treatment necessary is inversely related to temperature. Control of smut was obtained when containers were only half filled with soaked seed. A soaking period of only 2 hours in water gave control. (PDR 39: 20). V. F. Tapke reported physiological races in U. nuda, and techniques for their study. (Phytopath. 45: 73).

Stripe mosaic virus has been found in most States in the upper Mississippi Valley. In North Dakota over 90 percent of the fields examined were infected. Rod row trials indicated that the virus can cause severe yield reductions. "Resistance" to one strain of the virus was found in a few barley varieties. Limited studies indicated that this resistance can be transferred to other varieties. (Timian and Sisler. (PDR 39: 550)

SORGHUM SPP. SORGHUM: Harris and Luttrell summarized results of seed treatment tests and reported occurrence of diseases of grain sorghum in Georgia in 1954. (PDR 39: 329).

In 1954 seed-treatment tests for the control of covered kernel smut (Sphacelotheca sorghi) on sorghum were conducted at Beltsville, Maryland, Lincoln, Nebraska, and Ft. Collins, Colorado, and reported by Leukel, Webster and Porter. (PDR 38: 769).

TRITICUM AESTIVUM. WHEAT: Overland and Nelson reported the results of germination tests with treated winter and spring wheat seed at the Washington Agricultural Experiment Station, Pullman. Results indicated that fungicides should be tested more thoroughly before new methods of application are recommended. Copper carbonate slurry, assumed to be non-toxic like the corresponding dust treatment, proved injurious, particularly at low temperatures. (PDR 38: 25).

Cercospora herpotrichoides, Cercospora foot rot, was isolated from Cornell 595 winter wheat in Tompkins County, New York, in 1953 and reported from 25 counties in the State in 1954, according to Shoemaker and Tyler. (PDR 38: 710).

Erysiphe graminis tritici, powdery mildew. The influence of temperature on the development of powdery mildew on spring wheats was reported by Futrell and Dickson. The development of this organism was studied on 15 susceptible, intermediate, or resistant spring wheat varieties grown in the greenhouse at 16°, 20°, 24°, and 28 C. These 15 varieties showed a wide range in disease response when grown at the three lower temperatures. The resistant Hope variety showed a wider range of response than any of the other varieties. (Phytopath. 44: 247). D. A. Ray and others reported the inheritance of resistance to powdery mildew of wheat. (Jour. Agron. 46: 379). Allard and Shands reported inheritance of resistance to stem rust (Puccinia graminis tritici) and powdery mildew in cytologically stable spring wheats derived from Triticum timopheevi. (Phytopath. 44: 266).

Michael G. Boosalis reported that the recent increase in the infestation of wheat by Phytophaga destructor (Hessian fly) in Nebraska was shown to be correlated with a corresponding rise in the incidence of crown and basal stem rot, associated predominantly with Helminthosporium and Fusarium spp. The syndrome of Hessian fly-infested plants with crown rot was similar to that of plants damaged solely by parasitic fungi. (Phytopath. 44: 224).

The widespread occurrence of dryland root rot of winter wheat in eastern New Mexico in 1954 was caused by environmental conditions conducive to the disease development, susceptibility of all commercial varieties grown in the area, and abundance of root rot organisms in the soil. The following fungi were isolated from affected samples: Helminthosporium sativum, Rhizoctonia solani, Curvularia spp., and Fusarium spp. (PDR 39: 373).

Polymyxa graminis has been found widespread in wheat fields infested with the soil-borne wheat mosaic virus in Illinois, Virginia, Iowa, Kansas, and Oklahoma. The fungus developed well in pot cultures of wheat and spelt growing in sand or soil at temperatures between 60° and 65° F. There was no evidence that P. graminis can function as a virus vector or as a reservoir host. (PDR 38: 711).

Puccinia graminis tritici, stem rust, and P. rubigo-vera tritici, leaf rust. Actidione was the most promising of several antibiotics tested in the greenhouse and the field for control of stem rust (P. graminis f. sp. tritici), according to V. R. Wallen. (PDR 39: 124).

Pady and Johnston reported that spores of stem rust and leaf rust (P. rubigo-vera f. sp. tritici) were carried into Kansas in large numbers in the early part of the 1954 crop season. The minor epidemic that resulted was checked by hot dry weather which caused considerable

crop injury itself. There was good evidence, also, that conditions were favorable during September for a southward movement of stem rust that resulted in local outbreaks in volunteer wheat and moreover may have assisted in providing viable inoculum for the areas in southern Texas and Mexico where the rust overwinters. (PDR 39: 463). Twenty-eight physiologic races of wheat leaf rust were identified at the Kansas and Minnesota Experiment Stations, in cooperation with the U. S. Department of Agriculture, among 248 collections received from 26 States in 1953. Race 5 was the most prevalent in all the States, followed by races 15 and 105. Races 35 and 122 both increased in prevalence, particularly in Kansas and Texas; they attack most of the differential varieties and some other varieties with known resistance to other races. Race 58 was most abundant around the Great Lakes, along the southern Atlantic coast, and around the Gulf coast, race 93 in the Southeast, and race 11 in the Pacific Coast States. Race 9 continued to decline. (PDR 38: 647). Collections of leaf rust of wheat were received from 33 States in 1954. The data obtained from the study of 1143 isolates obtained from these collections showed the presence of 37 races of leaf rust in the United States in 1954. These races are listed by Johnston and Levine. (PDR 39: 463).

Tilletia sp., dwarf bunt. According to Pilgrim and Waldee, fall-sown wheat plants sprayed with Bordeaux mixture or dusted with Ceresan and lime 6 weeks after emergence from the soil had a lower percentage of bunted plants than did the untreated controls. The same fungicides applied to the plants 3 months after emergence had little or no effect on the incidence of dwarf bunt. (PDR 38: 750). S. G. Fushtey reported results indicating that proper seed treatment may aid control of dwarf bunt in spite of soil infestation. (PDR 39: 378). In cross inoculations reported by J. P. Meiners, wheat was infected by dwarf bunt from tall oatgrass (Arrhenatherum elatius) and intermediate wheatgrass (Agropyron intermedium). (PDR 39: 161).

Tilletia caries and T. foetida, common bunt of winter wheat in the Pacific Northwest is transmitted from one crop to the next by seed-borne and soil-borne spores. Control of infection due to seed-borne spores was possible by seed treatment. Certain mercury and copper fungicides have been used for this purpose in the Pacific Northwest for many years. These materials, however, are not effective against infection by soil-borne spores. Hence, there has been a long-felt need for a chemical which, when applied to the seed, will control bunt originating from both seed-borne and soil-borne spores. Holton and Purdy presented the results of tests with several chemical preparations which indicated that a product now commercially available under the brand name "Anticaric" would give satisfactory control. (PDR 38: 753). R. W. Leukel reported seed-treatment tests on winter and spring wheat and oats for smut control, 1953-54. At four stations all the materials eliminated bunt. At Pullman, Washington, with 80 percent bunt in the check, nine materials allowed from 0.2 to 3 percent infection. Five of these were mercurials. Only one material appeared to be harmful to the seed. The mercurials were more effective in checking seedling blight than were the five non-mercurials. (PDR 38: 755).

Ustilago tritici, loose smut. T. D. Persons reported a destructive outbreak of loose smut in a 40-acre wheat field in Jones County, Georgia, with a probable total loss of grain. (PDR 38: 422). In Minnesota, H. W. Schroeder reported the reaction of spring wheat varieties and selections to artificial inoculation with loose smut. (PDR 38: 882).

Mosaic Viruses.

The barley stripe-mosaic is seed-borne in wheat, according to experimental results reported by McNeal and Afanasiev. There was no apparent correlation between percentage of disease in the field and observed germination in the greenhouse. (PDR 39: 460).

Fellows and Sill reported a method of predicting wheat streak mosaic epiphytotics. For severe yield reduction to occur, field infection by wheat streak mosaic virus must take place in winter wheat in the fall, although symptoms are seldom seen until spring. Since the virus is not inactivated in the plant by low temperatures, a fall-infected plant retains virus through the winter. Dormant plants, therefore, may be transplanted to a warm greenhouse (70-80° F) during fall and winter where symptoms gradually develop in diseased plants. For 4 years random samples of winter wheat were gathered at approximately 10-mile intervals in the areas to be surveyed. Locations of positive and negative samples were charted on a map. (Phytopath. 44: 487).

W. H. Sill and others reported that the two important virus diseases of wheat in Kansas again caused heavy losses in the 1953-54 season. The soil-borne wheat mosaic was prevalent in hundreds of fields in most of the counties in the eastern third of the State. Losses from this disease averaged about 26 percent in the diseased spots checked in the 1953-54 season, as compared with average losses of 10 percent in diseased areas in 1951-52. The State loss for 1953-54 season was estimated at \$3,000,000, compared with \$1,500,000 in 1951-52. Wheat streak

mosaic virus was the major disease of wheat in Kansas in 1954 and was a major factor, along with the early drought and extreme soil blowing, contributing to yield reduction. The State loss caused by streak mosaic was estimated at \$14,000,000, which makes the 1954 season second only to the severe 1949 outbreak when there was an estimated \$30,000,000 loss. (PDR 39: 29). Sill and others reported that Kansas experiments in a wind tunnel indicated that a small amount of transmission of the wheat streak-mosaic virus may occur during strong winds because of direct abrasive leaf contact between diseased and healthy wheat plants. Soil particles in the wind did not increase the percentage of transmissions. Grazing and trampling by livestock and movements of machinery did not increase transmission in the field. Further evidence was obtained that Aceria tulipae is an important vector. (PDR 38: 445). S. M. Pady reported catching the mite vector (Aceria tulipae) of wheat streak mosaic on slides exposed in the air during June and July 1954 (PDR 39: 296).

ZEA MAYS. CORN: In Iowa, A. L. Hooker described a corn nursery employed for simultaneous evaluations for resistance to several disease and insect pests, and reported some of the findings in 1953 and 1954. (PDR 39: 381).

Benjamin Koehler reported positive correlation between resistance to Stewart's disease (Bacterium stewartii) and northern leaf blight (Helminthosporium turcicum) in corn (PDR 39: 164). The general occurrence of Stewart's bacterial wilt of sweet corn in New York during 1954 provided an opportunity to conduct tests on the control of this disease by streptomycin applied as a foliar spray. Although the sprays failed to exert any apparent therapeutic efforts against established infections, the treatments did provide some protection against new infections. (J. J. Natti, PDR 39: 386). C. W. Boothroyd and others reported results of a 1954 survey for stalk rot in New York. In isolations made from diseased stalks collected on the different farms, Gibberella zeae was recovered most consistently. G. fujikuroi was the next most common fungus recovered. No one factor or combination of factors could be found directly responsible for the severity of the disease. (PDR 39: 380).

Helminthosporium turcicum, crown rot. According to Cox and Wolf in the spring of 1954 a wilt disease was noted in several plots of Iowa inbred lines growing in the sweet corn disease nursery located at Pahokee, Florida. Later, several other inbred lines and hybrids became affected. (Phytopath. 45: 291).

Sclerophthora macrospora, downy mildew. Whitehead reported that a 100 percent infection with downy mildew of a 10-acre, creek bottom field of Texas Hybrid 30 corn was observed in August 1954 at De Leon, in north-central Texas. This field in past years has produced 100 to 125 bushels of corn per acre, but was completely destroyed by this disease in 1954. (PDR 38: 896).

Corn stunt (virus). According to Hildebrand the corn stunt virus disease has been reported in only the two States California and Texas. However, the leafhopper vector, Baldulus maidis, is more widely distributed than the disease, having been found in Arizona, Florida, and North Carolina also. It was found that B. maidis breeds prolifically and completes a generation in about three weeks. Some generations were as short as 18 days; others as long as 24 days. (PDR 38: 572).

DISEASES OF FORAGE AND COVER CROPS

D. A. Roberts and others reported diseases of forage crops in New York in 1954. Ninety meadows and pastures were inspected during the summer and when practicable the extent of crop losses caused by plant disease was estimated. (PDR 39: 316). Forage plant diseases observed in West Virginia during 1954 were reported by E. S. Elliott. (PDR 39: 318).

A foliage disease referred to as "aerial blight" or "summer blight" has been observed on a number of economic and wild plants in Louisiana in recent years and has caused considerable damage to some forage and hay crops in the State according to W. H. Stroube. The causal organism has been identified as Pellicularia filamentosa f. sasakii. Plants on which natural infection of the organism has been found in Louisiana are listed, also plants successfully inoculated. (PDR 38: 789).

GRASSES

In Rhode Island a survey of golf course greens was reported by Troll and Tarjan disclosing widespread occurrence of root parasitic nematodes associated with diseased patches. The authors called attention to the falsity of the view that nematodes are of only slight importance in "colder climates." (PDR 38: 342).

J. P. Meiners reported that snow mold of turf in the Pacific Northwest was associated with

either or both of two organisms: Fusarium nivale and Typhula itoana. Epidemiology depended upon certain weather conditions and varied with the particular organism involved. He gave the results of 3 years' testing of a number of fungicides for snow mold control on golf greens. (Phytopath. 45: 59).

M. A. Manzelli reported that field work initiated in 1953 and continued through 1954 has shown that O-2, 4 dichlorophenyl O, O-diethyl phosphorothioate is capable of controlling parasitic nematodes attacking turf and lawn grasses. Applied as a drench or spray, or injected into the soil at rates of 125, 250 and 500 pounds of technical grade material per acre, it has succeeded in reducing the populations of the pathogenic nematodes sufficiently to permit the grasses to regain their former vigor and growth. (PDR 39: 400).

J. R. Hardison reported some new grass host records and new data on the life history of dwarf bunt (Tilletia brevifaciens), in eastern Oregon. Spore balls of dwarf bunt were found in seed samples of Agropyron trichophorum, Festuca arundinacea, F. rubra, F. ovina var. duriuscula, and Poa pratensis, indicating the spread of infection to additional grass hosts in the area in 1952. The maximum tolerance now specified for all seed classes of susceptible varieties at field inspection is 0.5 percent infection. (PDR 38: 345).

AGROPYRON SPP. WHEATGRASS: In teliospore morphology and host range a form of Puccinia coronata, crown rust, observed on Agropyron in North Dakota resembled f. sp. secalis more than f. sp. avenae, according to E. A. Schwinghamer. Observations on spore morphology and limited pathogenicity studies with the uredial stage were made with a Fargo collection of this rust. The pathogenicity of this isolate on seedlings of some cereal and grass hosts is given in a table. The tribes Avenae, Festuceae and Agrostideae were characterized by immunity, while relative susceptibility was general in the tribe Hordeae that were sampled except members of the genus Triticum. (PDR 39: 345).

AGROSTIS SP. BENTGRASS: Association of nematodes with yellow tuft of bentgrass in Rhode Island was reported by A. C. Tarjan and others. (PDR 39: 185).

BROMUS SPP. BROMEGRASS: In Pennsylvania, Carnahan and Graham reported results of a search for sources of resistance in Bromus to the brown leaf spot fungus (Pyrenophora bromi). The moderately resistant tetraploid, B. sibiricus, appeared to be the only source of resistance for possible breeding material in the Bromopsis section. (PDR 38: 302).

DESCHAMPSIA. HAIRGRASS: Tilletia cerebrina parasitizes grasses in this genus, mainly in the western parts of the United States, Alaska and eastern Canada; it is also widely distributed in Europe. W. N. Siang described the characteristics and nuclear cytology of spore germination in T. cerebrina. (Mycologia 46: 238).

PENNISETUM GLAUCUM. PEARL MILLET: Diseases of pearl millet in Georgia were reported by E. S. Luttrell. In this review of the diseases of pearl millet it was stated that the most common leaf spots are those caused by Helminthosporium stenospilum and H. sacchari, occurring chiefly in the Coastal Plain, and Cercospora penniseti, most serious in the Piedmont. Diseases reported in other areas but not yet found in Georgia were listed. (PDR 38: 507).

LEGUMES

Brinkerhoff and others discussed the effects of chemical seed treatments on nodulation of legumes; they used soybeans, peanuts and cowpeas in their tests. Phygon, Spergon, and Arasan tended to reduce or in some instances nearly eliminate nodulation in non-infested soil when soybeans and cowpeas were grown from treated, inoculated seed. No evidence was obtained that the addition of nodule inoculum to the seed decreased the protective value of the seed treatment chemicals. Nodulation was not appreciably affected by seed treatments in naturally infested soil. (PDR 38: 393).

John W. Baxter reported diseases affecting forage legumes in Iowa in 1954. (PDR 39: 239).

Marmor medicaginis, alfalfa mosaic. In the 1954 plant disease survey for New Mexico, Leyendecker reported that alfalfa mosaic was positively identified as occurring on Trifolium repens, Melilotus officinalis and Medicago sativa. (PDR 38: 893).

CASSIA TORA. SENNA: Tobacco etch virus. C. W. Anderson reported that plants of C. tora are susceptible to systemic invasion by strains of tobacco etch virus and have been found infected under field conditions. The importance of Cassia as a source of etch virus in the

field is undetermined. Observations and an earlier report by Brooks suggest that field infection may be fairly common in Florida. In north-central Florida, Cassia plants do overwinter the virus but cannot overwinter it as they die. Evidence indicates that farther south Cassia plants may survive the winter and prove a year-round source of etch virus. (PDR 38: 736).

GLYCINE MAX. SOYBEAN: Kilpatrick and Hartwig discussed as factors affecting fungus infection of soybean seeds, planting date and stink bug injury. (PDR 39: 174, 177).

John Dunleavy reported soybean diseases in Iowa in 1954. (PDR 39: 169).

Incidence of soybean diseases in the Delta area of Mississippi in 1954 was reported by R. A. Kilpatrick. In general, fungus diseases were more prevalent than bacterial diseases. Observations on harvested seed showed only a small amount of purple stain (Cercospora kikuchii) in the fall of 1954, although the leaf bronzing stage of the disease had been prevalent earlier. (PDR 39: 578).

Diaporthe phaseolorum var. sojae, pod and stem blight fungus, was found associated with root and basal stem rot of soybean in four Illinois fields. In May 1954, soybean stems were collected from the soil of a field in which soybeans were last grown in 1951. The possibility was suggested that the pod and stem blight organism surviving on old soybean stems in the soil may infect the base of the plant, remain semi-dormant during the growing season and then spread throughout the plant as it matures. (J. W. Gerdemann). (PDR 38: 742).

LUPINUS SPP. LUPINE: Harvey W. Rankin reported that the treatment of lupine seed with Spergon under the environmental conditions pertaining to the Georgia Coastal Plain region reduced nodulation, growth, and nitrogen fixation to a marked degree. It does not follow that this would always take place whenever legume seed are treated with Spergon. Because of the susceptibility of lupine to a number of soil-borne diseases, it was recommended that the crop be planted not more than once in a 3-year rotation. It was found difficult to maintain a high population of Rhizobium bacteria in sandy soils under these conditions. (PDR 38: 744).

Microsphaera diffusa, powdery mildew, of lupines has so far been observed in greenhouses, but studies reported by Luttrell and Samples indicated that given a source of inoculum it could cause damage to blue lupines in the field late in the season. (PDR 38: 719).

MEDICAGO SATIVA. ALFALFA: Colladonus montanus in Washington occasionally attains high population densities on alfalfa. This species has been found on most varieties of stone fruit trees. H. R. Wolfe considers that this species is not an economic vector of the western X-disease virus comparable to C. geminatus or Scaphytopius acutus, and in controlled experiments it is less efficient than the rare but efficacious Fiebertella florii. (PDR 39: 298).

Phytophthora cryptogea, root rot. Donald C. Erwin has given the first expanded account of this Phytophthora root rot on alfalfa. The disease was found in 5 counties in California. (Phytopath. 44: 700).

Pratylenchus sp., meadow nematodes, were found in large numbers in roots of alfalfa that had been sown in winter wheat in the spring in Kentucky. As many as 104,500 nematodes and eggs per gm. of fresh roots were found in 2-month-old seedlings. Root damage was extensive and severe, and stand was severely reduced. After summer fallow, fall-sown alfalfa plants of similar size in the same plot had approximately 1/1000 as many Pratylenchus as spring-sown plants. Root injury was slight and stand was good. (Phytopath. 44: 542).

POA SPP. BLUEGRASS: In Nebraska, W. W. Ray reported that the lawn of Merion bluegrass reported heavily infected with rust (Puccinia graminis) in 1953 contained only a trace of rust in 1954. However, in Lincoln, another large lawn seeded to Merion bluegrass in the fall of 1952, and which had some rust in 1953, was severely infected with rust in 1954. (PDR 39: 438).

TRIFOLIUM PRATENSE. RED CLOVER: F. W. Poos and others reported investigations indicating that the clover root borer (Hylastinus obscurans) can spread both northern (Kabatiella caulivora) and southern (Colletotrichum trifolii) anthracnoses of red clover. (PDR 39: 183).

In Illinois, J. W. Gerdemann reported the pathogenicity of Leptodiscus terrestris on red clover and other Leguminosae. It has also been reported from roots of diseased alfalfa in Virginia. (Phytopath. 44: 451).

Kilpatrick and others reported the relative pathogenicity of fungi associated with root rot of red clover in Wisconsin. They found that many of the fungi concerned were also pathogenic to the crop in the seedling stage, the most virulent being three isolates of Pythium debaryanum,

one strain each of Pythium sp., Fusarium oxysporum, F. solani, and F. "roseum", and the one isolate of the black patch fungus (sterile fungus) tested. Moderate damage was caused by some isolates of Rhizoctonia, Phoma, and Gliocladium roseum. (Phytopath. 44: 292).

TRIFOLIUM REPENS. WHITE CLOVER: K. H. Garren in Alabama reported on disease development and seasonal succession of pathogens of white clover. This report has been presented in two parts to emphasize the ecological nature of the sequential relationships among societies of fungi pathogenic on white clover. Part I (PDR 38: 579) established the general background of the study, gave details on procedure, and presented a discussion of the fungi attacking leaf tissue. Part II has taken up stolon diseases and the damage-growth cycle. (PDR 39: 339).

TRIFOLIUM REPENS VAR. LADINO. LADINO CLOVER: Webb and Schultz reported a virus causing phyllody of Ladino clover in Maine and discussed its possible connection with potato purple-top wilt. This is the first report of phyllody in Ladino clover in the eastern potato-growing areas. Phyllody may indicate the appearance of a strain of the aster yellows virus complex new to the northern Maine potato area. (PDR 39: 300).

VICIA VILLOSA. HAIRY VETCH: Pratylenchus penetrans. Jensen and others described a technique for examining soil diffusion patterns of nematocides. (PDR 38: 680).

VIGNA SINENSIS. COWPEA: Cowpea seed treatment did not seem to be useful in Mississippi according to results of tests reported by W. W. Hare. (PDR 39: 580).

VIGNA SINENSIS AND CROTALARIA: Virus diseases: C. W. Anderson reported studies on viruses of Vigna and Crotalaria, in three parts. (PDR 39: 345, 346, 349, 354).

DISEASES OF FRUIT CROPS

Estimated loss from diseases of fruits and vegetables in Tennessee in 1954 was reported by J. O. Andes. (PDR 39: 280).

CITRUS SPP. CITRUS: Hendersonula toruloidea was shown to be a wound-invading pathogen capable of causing dieback and cankers on grapefruit trees in southern California. The fungus occurs frequently, but not consistently, in association with lesions of the Rio Grande gummosis type on grapefruit in the Salton Basin. Except under certain adverse environmental conditions, control measures for the fungus on Citrus species are unnecessary. (E. C. Calavan and J. M. Wallace. Phytopath. 44: 635).

Penicillium spp., mold. C. N. Roistacher and others reported good protection of citrus fruits from decay due to P. digitatum, green mold, and P. italicum, blue mold, in California with ammonia gas. (PDR 39: 202).

Pythium aphanidermatum, damping-off, has been reported by DeWolfe and others as the cause of seed bed damping-off of citrus in California. (PDR 38: 632).

The burrowing nematode, Radopholus similis, has been determined to be the cause of "spreading decline", a serious condition affecting citrus trees in Florida. W. A. Feder and J. Feldmesser have presented studies on the life history of this nematode. (PDR 39: 395). Nine additional hosts, six of which are weeds in citrus groves, of the burrowing nematode in Florida were reported by Troy L. Brooks. (PDR 39: 309).

Citrus tristeza virus was shown by graft transmission experiments to infect 17 satsuma orange varieties (C. reticulata) on various rootstocks and Meyer lemon tops grown on trifoliate orange (Poncirus trifoliata) in a variety collection near Winter Haven, Texas. Satsuma trees over 20 years old on certain citrange stocks still lived and bore fruit though infected with the virus, thus confirming previous findings that some citranges are tolerant. (Olson and McDonald. PDR 38: 439).

FICUS CARICA. FIG: Pellicularia koleroga, thread-blight, according to Tims and others, is the most important disease of figs in Louisiana. During the summer partial defoliation of many trees occurs in the southern part of the State, and if the fruit is then still immature it fails to ripen. There is often little permanent damage to the affected trees. One or two applications of tribasic copper sulfate in late May or early June usually give satisfactory control of the disease until after the fruit ripened in July. They listed 34 other plants, including tung,

Aleurites fordii, attacked by thread blight in the State. (PDR 38: 634).

FRAGARIA SPP. STRAWBERRY: Phytophthora fragariae, red stele, was reported by Goheen as one of the most serious diseases of the strawberry throughout the Temperate Zones. In susceptible strawberry varieties, the disease may spread rapidly and soon render the entire planting worthless. Studies were reported that demonstrated that fall-dug strawberry plants without macroscopic symptoms may carry the red stele fungus. (PDR 39: 141).

Sphaerotheca macularis (= S. humuli), powdery mildew, occasionally becomes a major disease of strawberries in the Pacific Coast States and is often serious in England. Under screen-house conditions which seemed most favorable to severe powdery mildew infection, 41 strawberry varieties were rated for infection. Eleven varieties were free of mildew and 8 others very resistant. Some others were very susceptible. Under field conditions, slightly less injury was observed than in the greenhouse. (G. M. Darrow and others. PDR 38: 864).

Virus diseases.

Darrow, Goheen and Miller reviewed the status of strawberry virus diseases in the United States, and outlined the importance of these diseases in commercial strawberry production, and the measures being taken to combat them. (Proc. Amer. Soc. Hort. Sci. 63: 547). A. C. Goheen described a method for determining the success of graft unions between plants in strawberry virus studies. (PDR 39: 31). According to Marcus and Darrow, intergrafting virus-free plants of eight strawberry varieties produced no virus symptoms. Virus-free stock of any two or more of the eight varieties can be grown in adjacent rows or fields and no harmful effect of one variety on another may be expected even though vector aphids are numerous. (PDR 38: 607).

P. W. Miller reported that the strawberry aphid (Pentatrichopus fragaefolii) will transmit strawberry viruses from detached strawberry leaves in petri dishes to indicator plants of Fragaria vesca. Non-persistent viruses are readily transmitted but persistent viruses are usually not recovered by this technique, probably because aphids cannot survive on the detached leaves for periods of time sufficient to acquire the persistent viruses. It was pointed out that this technique cannot be used to certify plants as virus-free because the persistent viruses are not detected. (PDR 38: 568). P. W. Miller also reported inactivation of non-persistent viruses in strawberry plants by hot-air treatment. (PDR 38: 827). Norman W. Frazier discussed sources and effects of infection of strawberry plants by the tobacco necrosis virus. (PDR 39: 143).

George M. Darrow reviewed the history of leaf variegation of strawberry. The evidence so far is that variegation is not due to a virus for after many trials by several workers it has not been transmitted. Apparently it is due to a frequently mutating or unstable gene and the tendency to mutate is inherited as a recessive. (PDR 39: 363).

MALUS SYLVESTRIS. APPLE: Erwinia amylovora, fire blight. Virulent cultures of this organism were isolated at the University of Missouri, from Jonathan apples picked in February 1954, from trees which had been severely diseased during the previous spring and summer. It was concluded that the bacterium may overwinter in diseased fruits in Missouri and Arkansas, where "hold-over cankers" are rarely observed. (R. N. Goodman. PDR 38: 414). Extremely good control of fire blight with antibiotics under epidemic conditions was reported by R. S. Kirby in Pennsylvania. Two bloom sprays of Agrimycin a streptomycin-Terramycin combination, applied in the regular schedule reduced the average number of infections per tree on Opalescent and Gravenstein to 0.92, compared with 88.5 for pheno-lead from petal fall to second cover and 106.5 for the regular schedule. Spread of infection down the spurs and into the branches was arrested in Agrimycin-sprayed trees, though pronounced in those receiving other treatments. (PDR 38: 432). Control of apple fireblight with sprays of Agrimycin, in Missouri was reported by R. N. Goodman. (PDR 38: 874). C. N. Clayton reported that five streptomycin formulations were compared for control of fire blight of apple trees in North Carolina in 1954. Streptomycin sulfate plus Terramycin, soluble streptomycin sulfate, and streptomycin nitrate were effective. (PDR 39: 128).

Podosphaera leucotricha, powdery mildew. In 1953 and 1954 powdery mildew of apple was very destructive in many orchards in Northwest Arkansas. Orchards of the Jonathan variety, which predominates, were most severely damaged. Circumstances that appeared to be at least partially responsible were the drought in Northwest Arkansas during the latter part of 1953 and into the growing season of 1954 and the elimination of the 1953 apple crop, for all practical purposes, by spring frosts, which resulted in greatly curtailing or eliminating regular spray programs. (PDR 38: 607). Antibiotics were included among the materials compared by Louis Beraha and others for control of apple powdery mildew. (PDR 39: 132).

PERSEA AMERICANA. AVOCADO: In California R. D. Raabe and G. A. Zentmeyer reported that in view of the extreme susceptibility of the rootstocks tested and because of the lack of an effective eradicator fungicide, land with a known history of Dematophora necatrix should be avoided when planning new avocado orchards. (PDR 39: 509).

T. W. Young described a technique for collecting migratory endo-parasitic nematodes (Radopholus similis, Pratylenchus sp.) from avocado roots, which was more efficient and more rapid than the Baerman funnel technique. He stated that with modification it could perhaps be adapted to other crops. (PDR 38: 794)

PONCIRUS TRIFOLIATA. TRIFOLIATE ORANGE: Tylenchulus semipenetrans, citrus nematode. Previous studies have shown that the common species of Citrus were susceptible to the citrus nematode, whereas the trifoliate orange was markedly resistant. James W. Cameron and others reported that in their study young seedling populations of Poncirus from 3 sources all showed a high degree of nematode resistance. Hybrid seedling populations were obtained from crosses between Poncirus and 5 Citrus species. These populations likewise all showed resistance, whereas accompanying nucellar seedlings of Citrus were usually susceptible. (Phytopath. 44: 456).

PRUNUS spp. Viruses: Brase and Parker described a decline of Stanley prune trees on Myrobalan rootstock (Prunus cerasifera) affected with chlorotic fleck. (PDR 39: 358).

Immunity to necrotic ring spot was not found in any of 122 species of Prunus tested, representing all botanical sections of the genus, and it was concluded that the probability of the occurrence of immunity to this disease within the genus is slight. The possibility that necrotic ring spot virus is an essential component of the sour cherry yellows complex was discussed. (R. M. Gilmer, PDR 39: 194).

Lambert mottle virosis. Afanasiev and Morris reported that a virus disease that closely resembles Lambert mottle is the most important virus disease of cherry in Montana. Positive transmission was obtained by bud inoculation. The disease is found only on Lambert and Peerless varieties of sweet cherry. Infected trees in the orchards were found in groups, which indicated that transfer of virus takes place from one tree to the next rather than over great distances. This disease has caused definite economic losses in the orchards since very often infected trees died in 3 years. (Phytopath. 44: 481)

X-disease virus. Experiments indicated that Colladonus clitellarius, though relatively uncommon, is partially responsible for field transmission of the virus in New York. The leafhopper appears to prefer Prunus spp., particularly chokecherry and plum, though it has been observed on a number of other plants. (PDR 38: 628).

PRUNUS AMYGDALUS. ALMOND: Cladosporium sp., scab, has during the past few years caused some economic loss in the almond orchards of certain areas in California. (J. M. Ogawa and others. PDR 39: 504)

The conidial stage of a powdery mildew, apparently Sphaerotheca pannosa, on an unknown variety of almond at the Tree Fruit Experiment Station at Wenatchee, Washington was brought to the attention of Roderick Sprague in June. Powdery mildew on almond seems to be uncommon, since no other reports from the United States were found. (PDR 38: 695).

PRUNUS ARMENIACA. APRICOT: Ring pox (virus). Cochran and Stout discussed the distribution, symptoms, transmission, control of, varietal reaction to, and effect of environmental factors on ring pox, with particular reference to southern California. (Bull. Calif. Agr. Exp. Sta., 42: 7-10.).

PRUNUS PERSICA. PEACH: Cladosporium carpophilum, scab. D. H. Petersen and J. C. Dunegan reported factors influencing the control of peach scab in South Carolina. (PDR 39: 134).

Diplodina persicae, storage rot. During July 1953 a decay of Elberta peaches in a commercial shipment from South Carolina was found to be caused by D. persicae, according to W. R. Wright and others. It was suggested that prompt precooling of the fruit and shipment under standard refrigeration should control the decay during transit. (PDR 38: 436).

Monilinia fructicola, brown rot. Post-harvest treatments for the reduction of peach decays was reported by W. L. Smith and others. (Phytopath. 44: 390). J. M. Ogawa and others reported that spray preparations containing captan, one of the carbamate compounds, or wettable sulfur, appeared to afford good protection to peach fruit against infection by the brown-rot fungus in central California. (PDR 38: 869). In tests reported by Alcorn and Ark in California candidin

as a fruit dip proved to be an excellent protectant against peach brown rot. (PDR 39: 210).

Xanthomonas pruni, bacterial spot cankers. Survival of this organism until late winter in summer cankers in South Carolina was reported by H. H. Foster and D. H. Petersen. (PDR 38: 783).

Apple mosaic (virus). H. C. Kirkpatrick in Washington reported results indicating that peach is susceptible to apple mosaic virus, that it may carry this virus under greenhouse conditions, and that mild symptoms may develop in the first flush of growth. It seemed possible that apple mosaic could exist and be overlooked in orchard peach trees. (Phytopath. 45: 292).

Phony peach virus. Millikan and Anderson summarized results of 24 years' phony peach eradication in Missouri. The results indicated that the spread of the phony peach virus can be economically controlled. All counties but one have been removed from the quarantine list and the low annual infection rate emphasized the value of the eradication program. (PDR 38: 834).

Wart (virus). In 1952 severe infection by peach wart virus was observed on several Candoka trees near Farmington, New Mexico. The disease, believed to have been introduced into the area on these trees as nursery stock, has for the past 15 years been confined to them without affecting adjacent trees of known susceptible varieties, indicating that no vector of the virus is present in the area. (J. E. Chilton, PDR 38: 329).

X-disease virus. H. H. Thornberry gave a preliminary report on insect transmission of eastern peach X-disease in Illinois. Transmission of the disease from infected chokecherry to peach was effected by a mass collection of insects, including Colladonus clitellarius, from an area where the chokecherry carried the disease. Individuals of C. clitellarius confined to diseased peach foliage died soon afterwards. This might explain the non-transmission of the virus from peach in nature although it can be carried from chokecherry to chokecherry and peach. The vector probably survives on peach long enough to transmit the virus but not to acquire it and then migrate to a healthy plant. (PDR 38: 412).

In Washington, the western X-disease virus remained active in stored peach budwood for a longer time than it was thought to do, according to tests reported by Cheney and Reeves. (PDR 29: 543).

PYRUS COMMUNIS. PEAR: Erwinia amylovora, fire blight. Tests have indicated that antibiotic sprays are highly effective in controlling blight on the extremely blight-susceptible Forelle variety in Oregon in 1954. (J. R. Kienholz, PDR 39: 208). In 1954, at Marysville, California, Bartlett pears were treated against blight with streptomycin-Terramycin mixtures. The results indicated that the streptomycin-Terramycin mixture applied as a spray was highly effective in pear blight control without causing the severe russet that often follows the use of copper sprays or dusts. (PDR 38: 666).

Fall application of boron sprays as a control for blossom blast and twig dieback of pears in Washington was reported by Folke Johnson and others. (Phytopath. 45: 110).

RUBUS spp. BLACKBERRY AND RASPBERRY: Pratylenchus spp., meadow nematodes. Some limited observations on occurrence of meadow nematodes on various blackberry and raspberry species and varieties were summarized by Austin C. Goheen. The surveys indicated that meadow nematodes were widespread on cultivated brambles in Maryland and North Carolina. In some cases these nematodes were found in very large numbers. Nematodes may be an important factor in the decline of some cultivated brambles in eastern North America. (PDR 38: 340).

RUBUS PRO CERUS. HIMALAYA BLACKBERRY: A mosaic disease, was ultimately fatal to Himalaya blackberry. The causal agent was transmissible by grafting to red raspberry and to peach. It appeared not to be transmitted through Himalaya seed. Symptoms in peach indicated a relation to yellow bud mosaic of peach. (S. M. Alcorn and others. Phytopath. 45: 272)

VACCINIUM spp. BLUEBERRY: Botrytis cinerea, blossom and twig blight. Pelletier and Hilborn reported that considerable crop losses of low-bush blueberries, chiefly V. angustifolium and V. canadense, but also V. corymbosum, occur in Maine through the blossom and twig blight. Laboratory experiments showed the temperature range for the growth of the fungus to be between 5° and 32° C, with an optimum at 23°. The optimum for conidial germination was 8° to 29°. In 1953 vancide ZW gave field control almost equal to fermate. (Bull. Maine Agr. Exp. Sta. 529, 28 pp). Pseudomonas sp., bacterial canker, has frequently caused severe losses in cultivated blueberries in Oregon, according to Vaughan and Boller, particularly on six varieties. In 1953-54 Bordeaux mixture and three other fungicides were applied to randomized repli-

cated plots in October and November. The results confirmed the effectiveness of Bordeaux mixture and indicated that other copper materials can also be used for control of the disease. (PDR 38: 867).

VITIS spp. GRAPE: John M. Harvey reported a method of forecasting decay in California storage grapes. Fumigation of California table grapes with sulfur dioxide surface-sterilized them and thereby reduced losses from decay in storage, but did not eliminate decay because the gas did not kill the fungi that had already gained entrance into berries before harvest. Most of the decay in stored grapes, in fact, resulted from incipient infections not evident at harvest. (Phytopath. 45: 229).

In California the use of protective fungicides in the field as an adjunct to post-harvest sulfur dioxide fumigation has significantly reduced decay in stored Emperor grapes. Captan, B-622, and Crag 5400 significantly reduced decay due to Botrytis cinerea in years when the organism was a major cause in grape decay. (J. M. Harvey. Phytopath. 45: 137).

Nematodes (Meloidogyne spp. and Pratylenchus spp.) probably are important in hampering establishment of grape replants in declining vineyards in California, according to D. J. Raski, who reported results of trials with soil fumigation. (PDR 38: 811).

In California, D. J. Delp reported the effect of temperature and humidity on the grape powdery mildew (Uncinula necator). (Phytopath. 44: 615).

Virus diseases.

Hall and Hewitt reported no success with a color reaction test to identify virus diseases of grapevines. (PDR 39: 150).

According to Freitag and Frazier tests were conducted to determine the percentage of leaf hopper vectors of Pierce's disease virus of grape that were carrying the virus under natural conditions in a number of different habitats. In these tests particular emphasis was placed on the three economically important vectors; the green sharpshooter, Draeculacephala minerva; the redheaded sharpshooter, Carneocephala fulgida; and the blue-green sharpshooter, Hordnia circellata. The results suggested that generally Pierce's disease virus occurred naturally wherever the three important vectors were found. Naturally infected leafhoppers occurred in widely different habitats in California such as the seashore, the high mountains, the desert, and the cultivated valleys. (Phytopath. 44: 7).

DISEASES OF NUT CROPS

P. W. Miller summarized incidence of nut diseases in Oregon in 1954. (PDR 39: 68).

CARYA ILLINOENSIS. PECAN: Cladosporium effusum, scab. R. H. Converse reported results of preliminary trials using eradicant sprays for pecan scab control. The disease is still very difficult to control in epiphytotic years, and the cost of protectant spraying is a considerable item in pecan production. At the end of the season when the trials were completed monocalcium arsenite was the only eradicant that gave significantly better results than the control. (PDR 38: 701).

DISEASES OF ORNAMENTAL AND MISCELLANEOUS PLANTS

R. A. Young discussed the serious and far-reaching results of the dissemination of plant diseases in nursery stock, including ornamental plants and fruit trees, with particular reference to observations made in Oregon. (PDR 38: 417).

Notes on diseases of cereals and ornamentals observed in West Virginia during 1953 and 1954 were recorded by E. S. Elliott. (PDR 39: 332).

Keller and Potter reported that Thielaviopsis root rot (T. basicola) has been observed in Maryland affecting several greenhouse ornamentals, including poinsettia (Euphorbia pulcherrima) which were severely damaged, cyclamen, begonia, Scindapus aureus, cineraria, and Gerba jamesonii, and also elm seedlings obtained from Wisconsin. (PDR 38: 354).

CALADIUM BICOLOR. CALADIUM: About 20 percent of a shipment of caladium tubers imported into California from Florida were found to have a soft rot similar to that caused by Erwinia carotovora. The entire shipment was returned. Isolations from these infected areas yielded a species of Botrytis which appeared to be B. ricini. (Segall and Fortuño, PDR 39: 283).

CAMELLIA spp. CAMELLIA: Sclerotinia camelliae, flower blight. N. N. Winstead and others reported that a survey carried out from 1951 to 1954, inclusive, showed that camellia flower blight, Sclerotinia camelliae, was present on 18 properties in four counties of North Carolina. The fungus was believed to have been introduced into most of these places one or two seasons prior to discovery. (PDR 38: 670). Gill and Ridley reported camellia flower blight from Augusta, Georgia, where it has probably been present in private gardens for several years. (PDR 38: 673).

Sclerotinia sclerotiorum, flower blight. In North Carolina Winstead and Haasis reported that S. sclerotiorum was capable of causing a flower blight of camellia similar to that caused by S. camelliae. Its importance as a cause of flower blight is not known. (Phytopath. 44: 717).

According to E. M. Hildebrand, during a survey carried out in 1952-54, of the diseases of ornamental plants in the Houston area of Texas, unsuitable soil and unsatisfactory drainage and irrigation were found to be mainly responsible for the death rate of camellias. Variegation, much of which is believed to be due to virus infection, was next in importance. (PDR 38: 566).

CHRYSANTHEMUM spp. CHRYSANTHEMUM: R. S. Robinson and others reported results indicating that streptomycin and oxytetracycline can be used to control bacterial wilt (Erwinia chrysanthemi). Streptomycin was more effective than oxytetracycline, for it provided protection at lower concentrations and was less toxic. (Phytopath. 44: 646).

Virus diseases.

Brierley and others reported that tomato aspermy virus, known in the United States since 1951, has been found to cause blight injury to flowers of some chrysanthemum varieties. Experimental inoculation resulted in infection in 38 species of 30 genera and 12 plant families and failed in 38 other species. They also named the aphids that have transmitted the disease. Vector relations of aspermy virus are discussed in relation to field spread, which is thus far unreported in the United States. (PDR 39: 152).

DAHLIA sp. DAHLIA: Spotted wilt (virus). A clone of the dahlia variety Rhythm, all plants of which were severely affected by spotted-wilt disease, was transformed into a healthy stock of plants by the rooting of small stem-tip cuttings. Several other dahlia varieties were similarly freed from this disease. Apparently the causative virus does not move freely toward the growing tips of dahlia plants but lags behind the growth of the stem. Recovered stocks remained free of disease when grown in the absence of a source of reinfection. (F. O. Holmes. Phytopath. 45: 224).

DIANTHUS CARYOPHYLLUS. CARNATION: W. D. Thomas reported that of five varieties tested at the Colorado Agricultural and Mechanical College for reaction to Pseudomonas caryophylli, Durango appeared to be immune and without any tendency to carry the pathogen in a masked form. White Sim and Skyline were semi-resistant and might serve as carriers, while Arapahoe and Miller's Yellow were susceptible and could not be considered as symptomless carriers. (Phytopath. 44: 713).

GLADIOLUS spp. GLADIOLUS: In this article on Botrytis diseases of gladiolus in the United States, originally prepared for the Gladiolus Disease Symposium sponsored by the North American Commercial Growers at Cleveland in 1953, the author (C. J. Gould) reviewed the existing literature, citing some 83 titles, and including some unpublished data. The effects of relative humidity, temperature, and other factors on the gladiolus corm during storage were discussed in relation to disease control. (PDR Suppl. 224, 33 pp.).

Fusarium brown rot, Fusarium oxysporum f. gladioli, has been reported to be destroying annually 50,000,000 gladiolus corms over an area of 8,000 acres in Florida. Control measures in the field have included replacement every third or fourth year with the healthiest corms from planting stocks, growing cover crops in two out of three years, and using resistant varieties. In storage the best control was obtained by soaking corms for 10 to 15 minutes in Dovicide B. (Seed World 75: 16, 1954).

Pseudomonas marginata, scab. Control of bacterial scab by various insecticides used as corm and soil treatments alone or together with fungicides was reported by J. L. Forsberg. (PDR 39: 106).

Frank A. Haasis reported that a sanitizing treatment of a Ceresan-M dip applied shortly after corm harvest effectively reduced storage loss in gladiolus caused by Stromatinia gladioli, without jeopardizing subsequent growth. (PDR 38: 518).

Virus diseases.

Early in 1954 the nursery inspectors desired a further survey for gladiolus viruses in Oregon to obtain data for their cleanup program. For an effective cleanup program roguing of all plants showing white streak and western aster yellows is absolutely necessary. At the same time plants with severe cucumber mosaic virus and ringspot virus should be pulled out. The fact that so little white streak was found as compared to other years indicates that the cleanup program already shows results. The gladiolus industry in Oregon in 1953 included 429 acres. (J. L. Heinis, PDR 38: 733). Evidence indicating aphid transmission of tobacco ringspot virus was reported by Smith and Brierley. (PDR 39: 35).

HELENIUM HOOPEsii. SNEEZEWEED: A new rust host, Puccinia conspicua on H. hoopesii, for the hyperparasite Cladosporium aecidiicola was reported by P. D. Keener. This is one of the few reports for this species of Cladosporium in the United States. Also associated with the same rust was Tuberculina persicina, which was present in the same rust sori with C. aecidiicola or in different sori. (PDR 38: 690).

HYDRANGAEA MACROPHYLLA. HYDRANGAEA: Philip Brierley at the Plant Industry Station, Beltsville, Maryland reported symptoms in the florist's Hydrangea caused by tomato ring spot virus and an unidentified sap-transmissible virus. (Phytopath. 44: 696).

ILEX GLABRA. GALLBERRY: J. H. Owen reported fasciation of roots of gallberry in Florida. Fasciation of aerial parts of plants is of common occurrence, but a search of the literature failed to reveal any information concerning fasciation of subterranean roots. (PDR 39: 242).

IRIS spp. IRIS: At the Plant Quarantine Branch, San Francisco, California, Leptosphaeria heterospora was frequently identified on iris rhizomes imported from abroad. Observations suggested that the fungus may occur in several localities in central and northern California on both native and introduced plants. It is probably of little or no consequence as a parasite (P. R. Frink, PDR 38: 674).

Sclerotium rolfsii, crown rot. C. J. Gould reported that crown rot of bulbous iris is world wide in distribution. Although most serious in warmer climates it has caused considerable damage in western Washington in certain years. Soaking infected bulbs for 3 hours in a warm (110° F) solution of formalin (0.5%) has given practical control in both experimental and commercial tests. This treatment should be supplemented by sufficient rotation, careful culling, and other sanitation practices. (Phytopath. 44: 711).

LILIUM LONGIFLORUM. EASTER LILY: Rosette (virus). Easter lilies of the Croft variety with symptoms suggestive of lily rosette were brought from West Virginia in March 1954. The vector of lily rosette virus, Aphis gossypii, was present on the lilies when received. The grower stated that 150 of 800 plants developed rosette and were unsalable. (Brierley and Smith, PDR 38: 739).

PELARGONIUM HORTORUM. GERANIUM: Xanthomonas pelargonii, bacterial stem and leaf spot, according to D. E. Munnecke, has severely limited the production of cuttings from field-grown geraniums in California for several years. No commercial variety of P. hortorum was found to be immune from the stem rot phase, but several varieties were resistant to the leaf spot stage of the disease. Infected cuttings serve as inoculum for adjacent healthy cuttings in the rooting bed. Field control measures must be based upon established disease-free planting stock, using 1-year rotated fields, and following strict sanitary measures. (Phytopath. 44: 627).

POTHOS AUREUS: In the spring of 1954 a severe epiphytotic broke out in a commercial greenhouse establishment in Missouri specializing in the sale and propagation of Pothos aureus, a popular variegated houseplant. Losses of 30 percent were commonly experienced, serious enough to make the profitable growing of the crop questionable. A Rhizoctonia sp. consistently was found associated with the disease. The use of sterilized soil apparently will control the disease. (Millikan and Smith, PDR 39: 240).

ZINNIA ELEGANS. ZINNIA: Sclerotium rolfsii, southern blight. In the 1954 survey for New Mexico, Leyendecker reported that southern blight was found to be responsible for a 25 to 30 percent loss of mature plants in a commercial seed field of zinnia at Garfield, New Mexico. The damage followed heavy rains where runoff water stood in low areas of the field. (PDR 38: 894).

DISEASES OF SHRUBS AND TREES

Diseases and insects affecting shade trees and ornamental shrubs commonly planted in Georgia are listed by Miller, Campbell and Thompson. The senior author has been observing ornamental plants in Georgia for more than thirty years. This period covered several noteworthy droughts (1925-26 and 1931-33) as well as other unusual climatic disturbances such as the severe freeze of November 27, 1951. In addition to these damaging climatic variants many diseases and insects new to this region have been introduced during this period. (PDR 38: 362).

The rose black mold fungus (Chalaropsis thielavioides) caused severe losses of evergreen grafting stock in a New Jersey nursery, according to Hess and Welch. The fungus has been identified as causing graft failure of Cryptomeria japonica, Ilex opaca, Juniperus virginiana, Thuja orientalis, and T. occidentalis. The probable source of the inoculum was understock of Cryptomeria japonica. (PDR 38: 415).

Davidson and Campbell reported that during routine studies Poria cocos was isolated from a variety of hosts from most of the important timber areas of the United States. A list of new hosts was given. (Mycologia 46: 234).

ACER spp. MAPLE: Phyllosticta leaf spot P. minima, was epidemic on maples in north-western Pennsylvania in the spring of 1954, according to C. L. Fergus. The disease was severe on red maple (A. rubrum), but less so on hard maple (A. saccharum). (PDR 38: 678).

ACER NEGUNDO. BOXELDER: E. R. Toole reported that Fusarium negundinis is consistently associated with red stain of boxelder in the Mississippi Delta. (PDR 39: 66).

CASTANEA DENTATA. CHESTNUT: Endothia parasitica, chestnut blight. Fifty years of chestnut blight in America is reported by Beattie and Diller. They give a brief review of the history, distribution, and spread in the United States over the last 50 years of chestnut blight, control investigations, and breeding for resistance. It was stated that between 1947 and 1954 the Division of Forest Pathology established in 11 eastern States 13 hybrid test plots each with 50 specimens of Clapper's, Graves', and Chinese hybrids. The last mentioned was the most promising and was recommended for small-block plantings; it should furnish within a decade a source of seed for further afforestation with chestnut in other areas. (Jour. For. 52: 323).

CHAMAECYPARIS LAWSONIANA. LAWSON CYPRESS: Phytophthora cinnamomi, root rot. Dewayne Torgeson reported that the tree root rot in Oregon, caused by P. cinnamomi, has also been found attacking Chamaecyparis lawsoniana vars. allumi and elwoodi, English yew (Taxus baccata), Japanese yew (T. cuspidata), Erica carnea, and Calluna vulgaris vars. alba and aurea in both nurseries and home plantings. He pointed out that the ease with which the pathogen is disseminated, its wide host range, and the lack of any practical means of control may result in P. cinnamomi becoming serious in Oregon. (Contr. Boyce Thompson Inst., 17, 6, pp. 359-373).

FRAXINUS spp. ASH: Puccinia peridermiospora, rust, appeared in epiphytotic form in Massachusetts, extending from the coast to about 30 miles inward. (D. P. Limber, PDR 38: 696).

LIQUIDAMBAR STYRACIFLUA. SWEETGUM: A southwide survey for sweetgum blight was reported by G. H. Hepting. Throughout the South, although sweetgum blight was common, it had not caused excessive mortality. Only 1 percent of all sweetgums tallied were dead, and only 1 percent of the Maryland sweetgums were dead. (PDR 39: 261). George Y. Young reported the progress of sweetgum blight in Maryland plots, 1952-1954. (PDR 39: 266). Investigations of possible causes of sweetgum blight were reported by F. H. Berry. He pointed out that many of the symptoms of the blight are characteristic of a systemic virus disease, however, his results were inconclusive. (PDR 39: 270).

PINUS ECHINATA. SHORTLEAF PINE: E. R. Roth reported the spread and intensification of the little leaf disease of shortleaf pine, associated with soil type and the presence of Phytophthora cinnamomi in southeastern United States. (Journ. For 52: 592).

PINUS PONDEROSA. PONDEROSA PINE: Cronartium coleosporioides, western gall rust, caused considerable damage to ponderosa pine in western Montana. This outbreak appeared to have started 15 to 20 years ago and was still active, judging by the ages of living rust galls which

ranged from 1 to 15 years. (C. D. Leaphart, PDR 39: 314).

PINUS STROBUS. WHITE PINE: Henry I. Baldwin reported widespread occurrence of needle blight on eastern white pine in New Hampshire this year. He concurred with earlier investigators that the trouble is related to drought injury in the preceding years. Affected trees were found on all types of soil and under different conditions of moisture, exposure and shade. The most severe symptoms were found predominantly in young trees on exposed dry sites. The injury was limited to white pine. (PDR 38: 725).

PLATANUS spp. SYCAMORE: *Gnomonia veneta*, anthracnose, was very severe throughout Illinois during the latter half of May 1954, resulting in partial to complete defoliation of trees of all sizes within one to two weeks from the first appearance of the disease. Trees in rural areas or in large parks in urban areas were more severely affected than those of comparable size in typical town areas, and large trees more than small ones. (G. H. Boewe and others, PDR 38: 597). Fungicide tests in 1954 for the control of sycamore anthracnose were reported by Schneider and Campana in Illinois. (PDR 39: 64).

QUERCUS spp. OAK: *Endoconidiophora fagacearum*, oak wilt. E. B. Himelick and others reported tests on insect transmission of oak wilt in Illinois. They concluded that infection is not likely to result until a spring temperature has been reached that will promote both germination of the spores and continued growth of the fungus. (PDR 38: 588). According to Griswold and Bart in Ohio early in 1954, transmission tests were made with adults of *Pseudopityophthorus pruinus* which were introduced into cages with test seedlings that had recently broken dormancy. Two cases of oak wilt fungus transmission resulted from these early 1954 tests. This successful transmission in the laboratory suggests that this bark beetle may be able to transmit the fungus in a similar manner to healthy oaks in the field. (PDR 38: 591). W. J. Stambaugh and others reported effects of temperature upon development of perithecia *in vitro*. (PDR 38: 592). In Pennsylvania the following reports were made on insect transmission: (1) Spores adhered to the external surfaces of nitidulid bodies, according to Yount and others, (2) Thompson described experiments with spore-infested insects caged on wounded healthy trees, (3) Morris and others used radioactive iodine for tagging experimental insects. (PDR 39: 54, 58, 61). Long distance transmission of the fungus in Wisconsin depends on occurrence of favorable conditions, according to L. H. McMullen and others. (PDR 39: 51). D. M. Norris, Jr., reported and discussed the results of several studies on the role of wounds in natural overland transmission of *E. fagacearum* in Iowa. Natural spread occurred in 31 of 122 red oak (*Q. borealis*) trees which were wounded during the period April 24 to June 22. (PDR 39: 249). In experiments reported by Jones and Bretz oak wilt was not transmitted by tools that had been used on diseased trees. (PDR 39: 498). C. L. Fergus reported the effect of temperature and nutrients upon spore germination in the oak wilt fungus. (Mycologia 46: 435).

Observations reported by J. S. Boyce, Jr. on the development of oak wilt in North Carolina and Tennessee indicated that on wilting trees that were felled and cut into logs during the summer, mycelial mat formation occurred only during autumn of the same year and the mats disintegrated by the following spring, while infected trees that were left standing produced mats in the spring. Since infection occurs mostly in the spring summer felling alone, without further treatment, may reduce the spread of the disease. (PDR 38: 676). Arthur W. Engelhard reported that oak wilt fungus mats and pads have been observed on members of both the red and white oak groups in Iowa. (PDR 39: 254). Early felling of diseased trees reduced mat formation in Pennsylvania tests reported by C. L. Morris. (PDR 39: 258). Merek and Fergus reported that the most significant result of preliminary studies at the Pennsylvania State College on the longevity of *E. fagacearum* in ten dying red oaks (*Q. borealis*) felled in 1952 was the maximum periods for successful isolation of the fungus, indicating its ability for survival in different treated materials (Phytopath. 44: 328). In Ohio, according to Spilker and Young the longevity of the fungus in lumber retaining bark was affected by temperature and moisture content. It was short lived in lumber blocks subjected to temperatures of 25° and 27.5° C. When the lumber was stored at lower temperatures, longevity increased. The apparent influence of moisture content on the longevity was such that as the moisture content decreased longevity also decreased. (PDR 39: 429). The oak wilt organism was first reported isolated from all parts of infected trees in 1944. In 1950 Kuntz and Riker pointed out the significance of preexistent natural root grafts between healthy and infected oaks as a means of local spread of the oak wilt disease. Workers in several States have reported longevity of the fungus in roots: Ohio, 9 months; Pennsylvania, 1 year; Wisconsin, 3 years. (W. L. Yount, PDR 39: 256). Aerial surveys carried out during the sum-

mer of 1953 by Federal and State agencies and by private concerns and individuals showed that oak wilt was still confined to the 18 States where it had been reported in previous years, though additional counties were affected within these States (M. E. Fowler, PDR 38: 595).

ULMUS spp. ELM: Ceratostomella ulmi, Dutch elm disease. The 1954 spread of the Dutch elm disease in Illinois was summarized by Campana and Carter. The disease spread extensively into northern and western Illinois and increased in southern and eastern parts of the State during 1954. The number of diseased trees increased so much that an accurate count throughout the State was no longer possible. (PDR 39: 245).

DISEASES OF SPECIAL CROPS

BETA VULGARIS. SUGAR BEET: Curly top (virus). C. L. Schneider reported occurrence of sugar beet curly top in Minnesota and Iowa in 1954, which adds evidence indicating eastward spread of the vector (Circulifer tenellus) and the virus. (PDR 39: 453).

DIGITALIS spp. FOXGLOVE: A small acreage of D. lanata has been grown commercially in Wisconsin since World War II with only minor losses from disease. During 1954, however, two diseases appeared which caused the growers concern. One was Colletotrichum fuscum which was present in every field. The other disease was a severe, malforming mosaic caused by tobacco mosaic virus. Sample counts in the most severely affected field showed over 50 percent of the plants infected. As far as the authors (R. W. Fulton and E. K. Wade) were aware natural occurrence of this virus on D. lanata had not been reported previously. (PDR 39: 284).

GOSSYPIUM spp. COTTON: Bollenbacher and Marsh described a fluorescent-fiber condition in raw cotton, associated with various organisms. Aspergillus flavus was found very regularly on the fluorescent fiber. Aspergillus niger and Rhizopus sp. were also commonly present, while various other organisms were somewhat less frequent. (PDR 38: 375).

GOSSYPIUM spp. COTTON: Fusarium and Verticillium wilt. Epps and others reported that a survey was carried out from 1951 to 1953, inclusive, to determine the damage caused by cotton wilt in 19 cotton-growing counties of western Tennessee, to establish more reliable criteria for wilt loss estimates, and to intensify experiments on disease control. Of every 100 acres inspected averages of 11 to 50 were infected by Fusarium, the incidence varying considerably from year to year, and 5 to 11 by Verticillium. The average annual loss was estimated at 9,209 bales (valued at \$1,197,000), 62 percent of which was due to Fusarium and 38 percent to Verticillium. (PDR 38: 304). In a study in Texas, of soil samples taken from different areas of cotton fields where the amount of Verticillium wilt varied widely it was found that the severity of the disease varied inversely with the salt concentration in the soil and sodium in the leaves. (Christensen and others. PDR 38: 309).

Fusarium oxysporum f. vasinfectum. In the Baton Rouge area of Louisiana the development of a high incidence of wilt in the highly susceptible Half and Half cotton variety is dependent on heavy soil infestation by the nematode Rotylenchulus reniformis according to D. C. Neal. (Phytopath. 44: 447).

During the third week of May 1954, young cotton plants were sent from Allendale County, South Carolina to Clemson College for diagnosis. Reddening of the leaves was noticeable in a number of fields in the County. The appearance of the lesions as well as that of the conidiophores and spores corresponded to those described by Tucker for Helminthosporium gossypii. (C. H. Arndt, PDR 38: 728).

Experiments reported by J. R. Brazzel indicated that the pink bollworm, Pectinophora gossypiella, is not an important factor in the incidence of cotton boll rots. (PDR 39: 583).

In Oklahoma, Brinkerhoff and others reported field tests with chemicals for the control of Rhizoctonia solani, responsible for severe seed decay, pre-emergence injury, damping-off, and and sore shin of cotton. (PDR 38: 467). Brinkerhoff, with others, also reported greenhouse tests with chemicals for the control of cotton seedling diseases. (PDR 38: 476).

Thielaviopsis basicola, root rot or "internal collar rot", was observed in cotton growing at the Shafter, California Field Station in the fall of 1953, according to J. T. Presley. The symptoms were typical of those occurring on mature plants. (PDR 38: 529). In the 1954 survey for New Mexico Leyendecker reported that black root rot was discovered in a commercial planting of upland cotton near Berino, New Mexico. Fifty to 60 percent of the plants in two areas

were killed by the disease. The disease had previously been reported from New Mexico on long staple cotton. The organism was associated with nematode galls. (PDR 38: 894).

Verticillium albo-atrum, Verticillium wilt. Staffeldt and Fryxell described a method of estimating reaction of cotton varieties and selections to Verticillium wilt. It was decided that the percentage of infected plants was not adequate in determining the tolerance of cotton to Verticillium wilt under New Mexico conditions. (PDR 39: 690). The presence of Verticillium wilt in cotton was not affected by root knot nematodes (Meloidogyne spp.), according to W. D. McClellan and others. (PDR 39: 226. See also under Fusarium).

In Texas, L. S. Bird reported that genetic-controlled carbohydrate and soluble nitrogen combinations in plant tissues caused resistance to the bacterial blight (Xanthomonas malvacearum) disease of cotton. In greenhouse experiments plants with weak resistance became highly resistant after treatment with ammonium nitrate. (PDR 38: 653).

Leaf crumple (virus). According to R. C. Dickson and others, for the past several years the leaf crumple disease of cotton has been observed in the Coachella and Imperial valleys of southeastern California. The incidence of the disease has increased throughout the summer in many seeded cotton fields. Stub (ratoon) cotton has often shown a high level of infection, sometimes reaching 100 percent by midsummer. Transmission of leaf crumple has been obtained only by grafting and by the transfer of adult white flies from diseased to healthy cotton plants. (Phytopath. 44: 479).

NICOTIANA Spp. TOBACCO: Estimated loss from diseases of tobacco in Tennessee in 1954 was reported by J. O. Andes. (PDR 39: 280).

Peronospora tabacina, blue mold, according to reports to the Plant Disease Warning Service was present in 1954 throughout the Georgia tobacco belt, also in Florida, South Carolina, North Carolina, Virginia, Tennessee, Maryland, Pennsylvania, Connecticut, Massachusetts, and Ontario, Canada. North Carolina experienced the worst outbreak of blue mold in the field during the entire history of the disease in the State. Damage was given as severe where control measures were not used or where fungicidal treatments were discontinued. Person and Garriss reported that it was conservatively estimated that loss of the first priming (sand lug leaves) and in some fields damage to second and third primings, amounted to 4 1/2 to 5 million dollars. (PDR 39: 228).

In Connecticut blue mold is most destructive in seedbeds but frequently also causes important losses of tobacco in shade tents and open fields. No blue mold warnings were issued in 1952 or 1953. However, warnings were issued in 1954. A detailed study of an epiphytotic in an open, commercial field of Broadleaf tobacco in 1954 revealed the manner of spread of the pathogen. (Waggoner and Taylor. PDR 39: 79). Clayton and Grosso reported that zineb-tobacco dust gave relatively poor blue mold control and that the zineb-pyrophyllite dust gave good blue mold control. Applied as a spray, both gave good blue mold control, indicating that the zineb in both mixtures was active fungicidally. It was concluded that the tobacco dust was mechanically a less efficient carrier of the fungicide than the pyrophyllite and to obtain equal blue mold control the zineb-tobacco mixture would need to contain more than two times as much zineb. (PDR 38: 771). In Kentucky, W. D. Valleau suggested that proper plant bed management could lead to eradication of the fungus in the Eastern United States. (PDR 29: 231). A series of greenhouse experiments were conducted at Beltsville, Maryland to test the fungicidal value of various antibiotics in the control of blue mold of tobacco. In one experiment a 0.01 percent aqueous spray of streptomycin sulphate reduced the percentage leaf destruction from 30 (untreated) to 1.8, being second only to Dithane (1.7) and superior to other antibiotics tested. (John J. Grosso. PDR 38: 333).

Phytophthora parasitica var. nicotianae, black shank. H. R. Powers reported studies at the North Carolina State College on the mechanism of wilting in tobacco plants affected with black shank. Results gave no support to the theory that wilting in black shank is a systematic effect of a toxic metabolic product of the fungus. The only explanation possible is that the loss of turgor is due to the blocking of water movement through the lesions. (Phytopath. 44: 513). J. L. Apple reported the preliminary results of an investigation which indicated the existence of pathogenic strains of Phytophthora parasitica var. nicotianae. It appeared that the isolates collected from severe disease locations are among the highly pathogenic group. Thus, it is possible that this is one of the factors involved in many North Carolina fields where moderately resistant tobacco varieties fail to control black shank, especially in those areas where the population of plant parasitic nematodes is very low. (PDR 38: 774). Laboratory, greenhouse and plant bed tests of 7 varieties and strains of flue-cured tobacco in the seedling and transplant stages showed wide ranges in levels of resistance to black shank. Plants of transplant size of both Dixie Bright

101 was as resistant as Dixie Bright 102. In plant bed tests on black-shank infested soil no diseased plants of Dixie Bright 101 or Dixie Bright 102 were seen, whereas, in some plots of the same tests all plants of the 400 variety were killed. (Lucas and Todd. PDR 38: 502). Johnson and Valleau reported on heterothallism in P. parasitica var. nicotianae. Results of their studies suggested the presence in Kentucky of four different strains of the fungus. (Phytopath. 44: 312). Incidence of black shank increased directly with soil pH in Florida experiments reported by R. R. Kincaid and Nathan Gammon. The critical pH for blackshank suggested by field observations in Kentucky was about 5.6. This was higher than that observed in the first year of the Florida experiment, which was 5.2 or lower. (PDR 38: 853). The first known case of blackshank from the Burley tobacco area of southwest Virginia was reported to the Plant Disease Warning Service. (S. B. Fenne).

Pseudomonas tabaci, wildfire. In experiments conducted by the Tobacco Experiment Station, Greeneville, Tennessee and the Field Crops Research Branch, Beltsville, Maryland, four sprays at weekly intervals of streptomycin sulfate gave good control of tobacco wildfire. The antibiotic appeared to be effective both as a protectant and an eradicant and improved the root systems of treated plants. (Heggsted and Clayton, PDR 38: 661). Results of Pennsylvania tests with streptomycin preparations for the control of wildfire were reported by R. S. Kirby. (PDR 39: 14). Beach and Engle reported wildfire control by streptomycin nitrate in Pennsylvania. (PDR 39: 15).

An outbreak of Pythium rot in the newly set fluecured tobacco crop in Virginia reached an epiphytotic status during the current transplanting season, according to W. A. Jenkins. The severity of the disease appeared to be due to the unusually wet cold weather which persisted since May 3. Additional contributing factors were mechanical injuries sustained by the seedlings either before or following transplanting. (PDR 38: 421).

In California, Siegel and Wildman reported some natural relationships among strains of tobacco mosaic virus. (Phytopath. 44: 297).

ORYZA SATIVA. RICE: In a survey reported by J. G. Atkins 18 different suspected or known parasitic nematodes were obtained from rice soils in Texas and Louisiana. (PDR 39: 221).

PARTHENIUM ARGENTATUM. GUYULE: Fusarium solani caused wilting of 9-month-old nursery plants of guayule in southwest Texas in 1951, and of 2-year-old non-irrigated plants in 1952 and 1953. So far the disease is of minor importance. In the field, all or only part of the branches wilt. (Don C. Norton, PDR 38: 500).

RICINUS COMMUNIS. CASTOR BEAN: A. A. Cook reported that a species of Pleospora was found on castor bean leaves on three different occasions during the summer of 1954. Mature perithecia of the fungus were found on senescent leaves, twice on the variety Cimarron at Gainesville, Florida, and once on variety U.S. 101 at Plymouth, North Carolina. (PDR 39: 184).

Sclerotium bataticola, charcoal rot, was found on castor bean at College Station, Texas, Blackville, South Carolina, Warsaw, Virginia, Beltsville, Maryland, and Gainesville, Florida in 1954. The causal organism, as isolated from castor bean at Gainesville, compared favorably with previous descriptions of S. bataticola spp. typica, and was infectious on bean and sesame as well as castor bean.

SACCHARUM OFFICINARUM. SUGARCANE: Physalospora tucumanensis, red rot. A yeast identified as Candida intermedia, found associated internally and externally with the sugarcane moth borer and one of its parasites in the adult stage, has been found to be strongly antibiotic against the sugarcane red rot fungus, but not against an associated red rot organism Fusarium moniliforme, commonly found in the Florida Everglades. The possibility of using C. intermedia by cultivating it on sterile cane juice or dilute cane molasses for inoculating cane cuttings or for the production of toxin for the control of the red rot due to P. tucumanensis was suggested. (B. A. Bourne. Phytopath. 45: 37).

DISEASES OF VEGETABLE CROPS

Estimated loss from diseases of fruits and vegetables in Tennessee in 1954 was reported by J. O. Andes. (PDR 39: 280).

The use of wild Lycopersicon species for tomato disease control was reported by S. P.

Doolittle. He stated that encouraging results have been obtained. (Phytopath. 44: 409).

Results of vegetable seed treatments in Louisiana were reported by Martin and Atkins. Tests were made during the winter of 1952-53 to study the effectiveness of various newer chemicals recommended for that purpose by the manufacturers. (PDR 38: 348).

J. M. Beal and others described a color test for viruses in plants. (PDR 39: 558).

In the 1954 plant disease survey for New Mexico, Leyendecker reported that curly top Ruga verrucosans was general over the State causing considerable damage to tomato, red pepper, and beans. Numerous commercial fields suffered from 25 to 50 percent loss because of the disease. (PDR 38: 893).

ALLIUM spp. CHIVES, GARLIC, ONION, SHALLOT: Experiments have demonstrated that several species of Allium and all of the horticultural varieties of Allium cepa tested were susceptible to Puccinia asparagi. Uredia developed on all the horticultural varieties of A. cepa tested, and were followed by telia in most cases. (Louis Beraha, PDR 39: 98).

Penicillium digitatum, Penicillium clove rot, During the 1953-1954 season many garlic plantings in California were heavily infected with Penicillium clove rot. Field examinations in December 1953 showed that from 90 to 95 percent of the planted cloves were infected to some degree. Later field observations in January 1954 indicated that about 5 percent of the young developing plants were severely damaged from the effects of this infection. (E. B. Smalley, Phytopath. 44: 506).

APIUM GRAVEOLENS. CELERY: In New Hampshire severely stunted and chlorotic celery plants with poor root systems were found to be growing in soil heavily infested with nematodes (Paratylenchus hamatus). Cropping the soil for one year with lettuce and spinach reduced the nematode population, and following the cropping system for another year entirely eliminated this nematode. (PDR 39: 307).

Observations on varietal susceptibility of celery to aster yellows virus in California were reported by Yamaguchi and Welch. The results did not necessarily indicate that some of the varieties tested were more resistant to the aster yellows virus than the others. The leafhopper vectors perhaps show varietal preferences in their feeding habits. (PDR 39: 36).

According to Geraldson, investigations at the Gulf Coast Experiment Station, Florida, showed that the black heart disease of celery is due to calcium deficiency in the growing point and may be completely cured by the application of 0.05 to 0.25 M solutions of calcium salts to the affected part. Repeated applications may be necessary to keep the heart supplied with sufficient calcium for healthy growth. (Proc. Amer. Soc. Hort. Sci. 63: 353).

ASPARAGUS OFFICINALIS. ASPARAGUS: Botrytis sp. of the cinerea type, die-back, was first observed in New Hampshire in the fall of 1951. The same type of injury was noted the following fall and again in 1954. Although Botrytis spp. have been reported to cause grey mold of asparagus shoots both in the field and in transit, A. E. Rich stated that he found no previous record of a Botrytis die-back of asparagus occurring in the United States. (PDR 39: 305).

Fusarium oxysporum f. asparagi, Fusarium wilt, was reported as a major factor in the decline and replant problem of asparagus in California by Grogan and Kimble. The fungus occurred to a greater or less degree in all plantings examined. (Phytopath. 44: 490).

BRASSICA OLERACEA var. BOTRYTIS. BROCCOLI, CAULIFLOWER: Corticium solani (Pellicularia filamentosa), black root (damping-off, wire stem) became so serious in western Washington that an economical control of the disease was necessary. Since pentachloronitrobenzene (PCNB) had given outstanding control of club root without injury to the plants, it was tested against the black root disease of cauliflower. Analysis indicated that results of the experiments were highly significant. (Leo Campbell, PDR 38: 859).

BRASSICA OLERACEA var. CAPITATA. CABBAGE: Fusarium oxysporum f. conglutinans, yellows. Tests reported by Robert B. Marlatt showed that some yellows-resistant cabbage varieties can be successfully grown in Arizona. (PDR 39: 414).

Peronospora parasitica, downy mildew. Chloranil (Spergon) gave best control of downy mildew of all the fungicides tested on heading cabbage in South Carolina, reported by W. M. Epps. (PDR 39: 89).

In Mississippi, D. C. Bain reported tests on black rot (Xanthomonas campestris) resistance in cabbage. The results were interpreted as evidence in cabbage of one or more factors for resistance to the fungus. (Phytopath. 44: 331).

CAPSICUM FRUTESCENS. PEPPER: J. L. Apple and D. F. Crossan described an apparently new *Pythium* stem rot and wilt of pepper observed in North Carolina. (PDR 38: 555).

The manner in which streptomycin controls bacterial spot (*Xanthomonas vesicatoria*) has been discussed by Crossan and Krupka in Delaware. (PDR 29: 480). For bacterial spot of chilli peppers, see under *Lycopersicon esculentum*.

CITRULLUS VULGARIS. WATERMELON: *Phytophthora parasitica*, fruit rot. In June 1954, attention was called to a watermelon fruit rot in an irrigated field in the lower Rio Grande Valley of Texas. The rot was more serious in 1954 than at any previous time. A 15 percent loss was sustained in some fields. (D. C. Norton and D. W. Rosberg. PDR 38: 854).

Sunburn. In Mississippi, G. K. Parris reported that sunburning of watermelon was reduced by the use of lime paste, for which he gave formula and method of application. In tests with the variety Blacklee, where no lime was applied 49 out of 65 melons sunburned, where lime was applied to companion melons in the same field only 15 out of 60 sunburned. (PDR 38: 529).

CUCURBITS. CUCUMBER, MELON, SQUASH: Evidence of seed transmission of the cucumber anthracnose pathogen (*Colletotrichum lagenarium*) was reported by Horn and Wilson. Transmission of the pathogen through the seed of cucumbers has been suspected for years, but no experimental evidence demonstrating this condition has been recorded in the literature. (Phytopath. 45: 348).

Crossan and others reported that a hitherto undescribed leaf and stem blight of summer squash (*Cucurbita pepo* var. *condensa*) occurred periodically in North Carolina. Fruits were also infected. The disease was severe in warm, moist weather and occasionally caused complete loss of some plantings. A fungus identified as *Phytophthora capsici* was isolated from diseased plants. (PDR 38: 557).

Pseudoperonospora cubensis, downy mildew. In South Carolina, Barnes and Epps reported a "brown lesion" type of resistance in cucumbers to downy mildew, different from the hitherto known "yellow lesion" type. (PDR 38: 620). According to reports to the Plant Disease Warning Service in 1954, downy mildew of cucurbits was found in the Atlantic Coast Seaboard States as far north as Connecticut and also in Arkansas and Texas. The disease seemed to spread in the coastal areas rather than farther inland. In unsprayed fields the damage to the crop was heavy, and severity on cucumbers in Delaware was as high as 50 percent. However, where control measures were applied properly and maintained throughout the season, excellent control was obtained. Nabam plus zinc sulfate was reported as giving best control. Zineb spray or dust also proved very effective.

The reappearance in 1954 of cantaloupe downy mildew in a severe form in the lower Rio Grande Valley of Texas after an apparent absence of three years was due to the unusually wet and humid spring, according to G. H. Godfrey. A comparison of the 1954 data with those of previous years showed a relation between incidence and high early morning relative humidity. The possibility of applying daily weather reports to better advantage in timing fungicidal applications was discussed and a closer cooperation with the Weather Bureau and the Extension Service was advocated. The establishment of a downy mildew spray warning service for the area was recommended. (PDR 38: 616). F. S. Beecher reported experimental results in which certain mixtures of a fixed copper and a dithiocarbamate gave better control of cucurbit downy mildew (*P. cubensis*) than either material alone. (PDR 39: 220).

Virus diseases.

N. Tomlinson reported that root extracts are more infective and more stable than top extracts from cucumber plants infected with a cherry virus. (PDR 39: 148).

Whitaker and Bohn reported mosaic reaction and geographic origin of about 700 accessions of *Cucumis melo*. The data indicated that the best sources of resistant plants are China and neighboring Korea, followed by northern India and Pakistan. (PDR 38: 838). Harvesting operations can be a major factor in the spread of mosaic in Oregon cucumber fields, according to Amen and Porter. (PDR 38: 841).

HIBISCUS ESCULENTUS. OKRA: *Verticillium* wilt, see under *SOLANUM MELONGENA*.

IPOMOEA BATATAS. SWEETPOTATO: *Rhizopus* spp., soft rot. Robert Aycock reported that dipping sweetpotato roots in borax solutions of 1% and 2.5% concentration effectively reduced soft rot when they were taken from storage and repacked. Recuring for 48 hours at 85° F with relative humidity 60 percent or above appeared to be as effective as borax treatments. (PDR 39: 409).

Internal cork virus. Harvey W. Rankin reported that development of internal cork symptoms is apparently correlated with size of the roots. (PDR 39: 455). At the North Carolina State College, Raleigh, A. S. Williams reported development of foliage symptoms associated with internal cork of sweetpotato. (Phytopath. 44: 334).

Webb and Hanson reported mechanical and aphid transmission of the feathery mottle virus of sweetpotato. This virus was found in Wisconsin in 1951 and Louisiana in 1952. (Phytopath. 44: 290). Webb also reported some hosts of feathery mottle virus of sweetpotato. (PDR 38: 448).

LACTUCA SATIVA. LETTUCE: Bremia lactucae, downy mildew, according to R. S. Cox, is the primary and frequently sole disease during the winter months in the Florida Everglades. If cool weather persists, as happened in the spring of 1954, the disease may remain a serious problem into March and April. Experimental work showed that zineb adequately controlled downy mildew. (PDR 39: 421).

Erysiphe cichoracearum, powdery mildew. Studies on the epidemiology and host range of this organism in California are reported by J. A. Deslandes. Until recently no mention has been made of powdery mildew as a serious disease of commercial fields of lettuce. (PDR 38: 560).

According to Padhi and Snyder a disease affecting all the lettuce varieties grown in the Colma coastal district of San Mateo County, California, during the past 20 years, especially during the rainy winter season, was characterized by the development on the leaves of brown circular, zonate spots. The causal organism was found to be a form of Stemphylium botryosum, the imperfect stage of Pleospora herbarum. Because of its selective action on lettuce the fungus is designated S. botryosum f. lactucum n. f., the imperfect stage of P. herbarum f. lactucum n. f. (Phytopath. 44: 175).

LACTUCA SATIVA. LETTUCE: Big vein (virus). Although big vein occurs every year in California, especially in the spring crop of the central coastal area where practically 100 percent of the plants in some fields are affected, it usually has not been considered a serious factor in limiting production. Data presented in a table showed that big vein affects yield, but not in a straight-line relationship correlated with percentage infection as is usually true of a disease with a syndrome that renders the lettuce completely unmarketable. Big vein exerts its greatest effect on yield during weak market periods. (F. W. Zink and R. G. Grogan, PDR 38: 844).

Brown spot of head lettuce found on eastern markets is apparently not a specific disease entity but a complex of symptoms, according to B. A. Friedman. The breakdown is probably physiological in nature and may develop in response to a number of different adverse conditions in the field or while the lettuce is in transit or storage. (PDR 38: 847).

Tipburn and rib discoloration. Stewart and Foster reported comparative susceptibility of lettuce varieties to rib discoloration and to tip burn. (PDR 39: 418).

LYCOPERSICON ESCULENTUM. TOMATO: Alternaria tomato, nailhead spot, was found to a damaging extent in the Lower Rio Grande Valley of Texas in the fall of 1953. The disease occurred again in the fall of 1954 but was not quite so severe as in 1953. (Godfrey and Harrison, PDR 39: 185).

Botrytis cinerea, gray mold, and ghost spot have become serious diseases of tomatoes in Florida, according to J. F. Darby. Results of experiments in the greenhouse to reproduce ghost spot were partly successful. Histological studies failed to show that ghost spot was caused by an insect or a fungus; however, the nature of the injury suggested the latter. In fungicide trials conducted over a 3-year period (1951-54) 50% wettable dichlone was the most effective material tested for both diseases. Mixtures of dichlone and zineb were found to be promising in the control of gray mold, ghost spot, and gray leaf spot. (PDR 39: 91).

The occurrence of bacterial canker, Corynebacterium michiganense, on tomato under field conditions in South Carolina was reported to the Plant Disease Warning Service.

In Connecticut, Waggoner and Dimond reported the reduction of water flow by mycelium of Fusarium oxysporum f. lycopersici in wilted tomato plants. (Amer. Jour. Bot. 41: 637).

Heterodera marioni, root knot nematode, Systox used as a soil drench did not give good control of root knot of tomato in experiments reported by Max Fielding. (PDR 38: 807).

According to Hopper and Tarjan, chlorophenyl methyl-rhodanine (N-244), used as a soil drench at the rate of 3 grams per square foot, was found to be an effective eradicator of root knot nematode (Meloidogyne incognita) infection of tomatoes under greenhouse conditions. It was observed that the chemical was toxic to roots of treated plants and also the nematodes con-

tained therein. (PDR 38: 542).

Orobancha ramosa, branched broomrape, has been found troublesome on tomatoes in a few fields in Alameda County, California, according to Stephen Wilhelm. The apparent capacity of the broomrape seed to lie dormant in soils for long periods, and of the parasite to recur in profusion in response to planting a favorable host such as tomato, has been well established by field observations. Spread in California has been accounted for by flood waters and by transportation of seed-infested soil on farm implements. (PDR 38: 890). Wilhelm and Benson reported that special fumigation techniques may be required for eradication of broomrape because the seed is present in the surface layers of the soil. Their data did not indicate that broomrape seed persisted in the surface soil, however, nor that it was resistant to drying since the soil had been plowed and disced within one month of obtaining the samples. (PDR 38: 553).

Phytophthora infestans, late blight. Potato and tomato late blight as reported to the Plant Disease Warning Service occurred in many States and Canada, but its importance in 1954 was limited to localized severe outbreaks. These outbreaks affected tomato in Mississippi, and potato in Aroostock County, Maine, where the epidemic was the most severe in the history of the State. No blight was found in the green-wrap tomato areas of Georgia, the plants as a whole being relatively free from plant diseases this year. This was the first year since 1946 that late blight was not observed in green wrap fields. Its absence was due to above-normal temperatures and below-normal rainfall.

Rich and Richards reported a source of resistance to tomato late blight. Several hundred native and foreign tomato accessions have been screened for resistance to late blight at Durham, New Hampshire during the past few years. A cherry tomato (Lycopersicon esculentum var. cerasifolium) was found to be highly resistant. (Phytopath. 45: 186).

Pythium spp., damping off. According to M. C. Strong, in experiments at the Department of Botany and Plant Pathology, Michigan State College, on the control of damping-off of tomato seedlings, all the fungicides tested except manzate were effective both as soil treatments and dusts. Dusting was recommended in preference to soil treatment because it is easier, requires less fungicide, and the abundant hairs on the tomato seed retain the fungicide well. (Bull. Michigan Agr. Exp. Sta. 36: 285. 1954).

Sclerotium rolfsii, southern blight. Soil treatment tests with chlorobromopropene for the control of southern blight of tomato in Texas was reported by P. A. Young. He suggested that further tests should be made with this material to determine a method of commercial use. (PDR 38: 858).

David Gottlieb and others described a new antifungal agent, filipin, produced by an undescribed streptomycete. The incidence of gray leaf spot, Stemphylium solani, of tomatoes was reduced 25 percent under treatment when the plants were artificially infected in the greenhouse. (PDR 39: 219).

Xanthomonas vesicatoria, bacterial spot, has been serious for many years on tomatoes and peppers in the vegetable growing areas along the lower east coast of Florida. Seedlings for autumn and winter crops are particularly affected and when transplanted to the field may suffer considerable losses during heavy rains. In the autumn of 1953 a large scale experiment was carried out in commercial tomato plant beds to determine the effectiveness of a formulation of Agrimycin, containing 22.2 percent streptomycin and 2.2 percent Terramycin, in controlling the disease. None of the treatments caused visible injury to the seedlings. In a small-scale experiment with chillis, using a compressed-air sprayer, a 300: 30 p.p.m. concentration gave effective control. (R. A. Conover, PDR 38: 405). Partial success with streptomycin for control of bacterial spot in southern Florida indicated need for further study of disease development in relation to control, according to D. M. Coe. (PDR 39: 215).

Yellow-net virus. E. S. Sylvester reported that since 1946 a yellow-net virosis had developed sporadically in tomato plantings at Berkeley and twice in fields at Salinas, California. Myzus persicae proved to be a relatively inefficient vector, transmitting the virus in about 17 percent of 217 trials with 10 individuals per plant. (Phytopath. 44: 219).

Blossom-end rot. D. C. Bain in Mississippi reported observations which showed that the percentage of blossom-end rot of tomatoes was lower on plants not staked and pruned once than on those staked and pruned at least twice, the ratio of diseased fruits on plants in the two categories being about 1:6 and 1:2 in 1953 and 1954, respectively. Drastic changes in the rate of transpiration of the staked plants due to exposure to sudden and strong air currents and to reduced mulching and shading of the roots may be responsible for their susceptibility. (PDR 38: 721).

PETROSELINUM CRISPUM LATIFOLIUM. PARSNIP: Pythium debaryanum, Pythium root

rot, was isolated from parsley near Grand Rapids, Michigan. It caused root rot and loss of vigor during the cutting season. Yields were reduced as much as 50 percent in fields where the disease was severe. (Phytopath. 44: 486).

PHASEOLUS LIMENSIS. LIMA BEAN: In Delaware, R. A. Hyre's microclimatological study showed a considerable differential between relative humidity records taken among lima bean plants and 5 feet above, whereas temperature differences were slight. For the purposes of forecasting downy mildew (Phytophthora phaseoli) temperature measurements need not be made among the plants or even in their immediate vicinity. (PDR 39: 473).

The effect of temperature on the development of downy mildew of lima bean was reported by R. S. Cox in Delaware. (Phytopath. 44: 325).

Wrinkled seed coat. Neuburg and others reported a testa deformity of lima beans in Santa Clara and Monterey Counties, California, affecting chiefly the Concentrated Fordhook variety and associated with stunting of the plants. It was responsible for lowering the grade of the frozen product and caused losses of \$30,000 to \$45,000 per season to some factories. On a light soil 3.4 percent of the beans were wrinkled with normal irrigation and 8.8 percent when two irrigations were omitted. (PDR 38: 464).

PHASEOLUS VULGARIS. BEAN: Fusarium spp., root rots, of bean have caused much concern to growers in Wyoming where the crop is grown under irrigation. Seed treatment tests were conducted with three varieties to ascertain the effect of certain compounds on the development of root rot and resulting yields. It was found that there was no direct correlation between treatment and severity of root rot or yield. Since Fusarium spp. are ever-present in the soil and usually attack plants after they have passed the seedling stage, not enough fungicide could be applied by treating seed to prevent infection of bean plants. (H. J. Walters. PDR 38: 856). H. J. Walters reported that increased yields brought about by supplying water to the root zone of bean plants infected with root rot may be explained by the assumption that the moisture prevents wilting and makes nutrients available near the surface of the soil. (PDR 39: 101).

Mitchell, Zaumeyer and Preston reported absorption and translocation of streptomycin by bean plants and its effect on the halo (Pseudomonas phaseolicola) and common (Xanthomonas phaseoli) blights. (Phytopath. 44: 25).

Rhizoctonia solani, root rot. Moore and Conover reported results with chemical soil treatment for control of Rhizoctonia on snap beans in Florida. Results indicated that both PCNB and the experimental compound No. 363 reduced Rhizoctonia infection on snap beans under field conditions, but until losses from this organism can be definitely determined the value of treatments for its control is conjectural. (PDR 39: 103).

Uromyces phaseoli, rust. Candicidin strongly inhibited germination of a number of fungi tested and greatly reduced infection by bean rust, according to experiments reported by Alcorn and Ark. (PDR 38: 705).

Xanthomonas phaseoli, bacterial blight. J. D. Menzies reported the effect of overhead sprinkler irrigation on the amount of bacterial disease damage to beans under the typically arid climate of the Columbia Basin region of Washington. None of the four bacterial diseases observed occurred in this area on beans irrigated by the furrow method but all appeared late in the growing season on sprinkled fields. It was concluded that in the normal climate of this area beans can be irrigated by overhead sprinkling without serious danger from bacterial diseases provided they are planted early enough to mature before October. (Phytopath. 44: 553). R. B. Marlatt reported that streptomycin was not effective against bacterial blight of pinto bean in Yavapai County, Arizona, where epidemics occur annually. (PDR 39: 213).

A rapid greenhouse method for testing beans for resistance to bean mosaic virus has been developed at the Plant Industry Station, Beltsville, Maryland, according to Thomas and Fisher. (PDR 38: 410).

Yellow bean mosaic caused by bean virus 2 is an important bean disease in Idaho and in other States of the Pacific Northwest, according to Hungerford and Hillyer. The occurrence of this virus is associated with its principal host, Melilotus alba. The disease is prevalent in sweet clover even in isolated areas far from cultivated fields. The virus is readily transmitted by several aphids. Numerous strains of this virus have been reported. From inoculation experiments, five new hosts for the type strain of bean virus 2 were discovered. (PDR 38: 621).

PISUM SATIVUM. PEA: Kingsland and Rich reported studies on the cause and control of pea root rot (Fusarium solani) in New Hampshire. This disease is a serious problem in the State. Nine soil fungicides were tested in naturally infested soil, but only Stauffer N-869 in-

creased the yield significantly in comparison with the check which became severely infected. (Phytopath. 45: 185).

From the New York Agricultural Experiment Station A. W. Hofer contributed a diagnosis of Phagus rhizobii, the well-known but hitherto, undescribed virus that destroys the root nodules of peas (Rhizobium leguminosarum) and other legumes. (Soil Sci. 77: 435).

RAPHANUS SATIVUS. RADISH: Peronospora parasitica, according to G. B. Ramsey and others, is either uncommon on radishes or has not been recognized, but root discoloration by the fungus caused heavy losses on the Red Globe variety grown in the market-garden district south of Chicago during October 1953. Similar damage to topped radishes pre-packaged in polyethylene bags was also observed at shipping points in Texas and Florida during February and March 1954. (Phytopath. 44: 384).

In Florida, Thompson and Decker described two types of hypocotyl discoloration of harvested radishes. Investigations in May 1954 showed that one type of discoloration was largely present at the time of harvest. Downy mildew, Peronospora parasitica was found associated. The second type was due to unknown causes. (PDR 39: 416).

SOLANUM MELONGENA. EGGPLANT: In New York, investigations reported by Fassuliotis and Feldmesser showed that the potato golden nematode (Heterodera rostochiensis) can attack and complete its life cycle on eggplant. (PDR 38: 789).

Verticillium albo-atrum, Verticillium wilt. In the 1954 survey for New Mexico, Leyendecker reported that Verticillium wilt was found for the first time causing extreme damage on eggplant and okra. Large commercial plantings in the Mesilla Valley suffered from 50 to 90 percent loss in production. The disease was also found affecting eggplant under field conditions north of Vernalillo, New Mexico. (PDR 38: 789). During 1954 Staffeldt and Leyendecker observed Verticillium wilt of okra and eggplant under field conditions in Southern New Mexico. The commercial planting of okra in which Verticillium wilt was studied was a 4-acre field. By the end of the season from 90 to 95 percent of the plants were diseased. Yield was very severely affected by the wilt disease. It was estimated that 75 percent of the crop was lost in this one field. A 3 1/2-acre eggplant field on the same farm was also found to be severely infected with Verticillium wilt. The disease appeared early in the season and continued to increase in incidence until frost, when 95 to 98 percent of the plants were infected. The grower considered the crop a complete loss. (PDR 39: 589).

SOLANUM TUBerosum. POTATO: Several species of Chaetomium were associated with a foliage disease of greenhouse-grown potatoes in South Dakota, according to Allyn A. Cook. Disease symptoms comparable to those from which the original isolations were made were never obtained on inoculated plants, but the results of preliminary experiments indicated that the species of Chaetomium tested were capable of inducing a foliage disease of potatoes, either by indirect infection or by production of toxic materials. (PDR 38: 403).

Erwinia atroseptica, black leg. Laboratory and greenhouse studies in Maine have shown that treating potato seed pieces in solutions of streptomycin sulfate, with or without the presence of Terramycin hydrochloride, was effective in reducing both black leg and the seed-piece decay caused by black leg bacteria. Treating seed pieces in Agrimycin solutions on commercial farms reduced the amount of seed-piece decay, generally increased the emergence in the field, greatly reduced the percentage of blackleg, generally improved the color size and vigor of the plants, and always increased the yield rate. (Reiner Bonde, PDR 39: 120).

Heterodera rostochiensis, golden nematode. Fassuliotis and Sparrow reported that X-ray irradiation at certain dosages interrupted the life cycle of the golden nematode. (PDR 39: 572). None of the filtrates from 22 different bacteria and fungi tested by W. F. Mai proved to be toxic to encysted larvae of the potato golden nematode. Data were presented only for encysted larvae treated for 30 minutes in 1:9 dilutions. (PDR 38: 545). Two organic mercurials used in the Netherlands were tested for the control of the potato golden nematode in New York by Feldmesser and Shafer, with promising results. (PDR 39: 13).

Phytophthora infestans, late blight, see also under tomato. Reiner Bonde reported results of a late summer potato late blight survey in Aroostook, Maine. (PDR 39: 86).

Streptomyces scabies, scab. Houghland and Cash described two methods of inoculation with S. scabies which have proved very effective in establishing potato scab in the field at the Plant Industry Station, Beltsville, Maryland. (PDR 38: 460).

Pentachloronitrobenzene was the most effective of several soil fungicides tested for the control of scab, according to Houghland and Cash. (PDR 38: 777).

A. A. Cook reported association of several strains of virus X with "freckles", observed in potatoes in South Dakota. (PDR 38: 458).

Evidence associating the occurrence of potato internal brown spot with hot dry weather was reported by B. A. Friedman. He also reviewed the literature on internal brown spot and similar troubles. (PDR 39: 37).

Leaf roll, unidentified (probably not of virus origin), according to Volk and Gammon, occurring on potatoes in Florida was most severe on relatively new lands where there are very acid conditions and high ammonia content. It appeared that this leaf malformation could develop at any stage of growth if the plant had insufficient supplies of nitrate. In Florida tests deficiency of potassium was thought to be an enhancing factor. Side dressings of nitrate at planting and potassium nitrate at blossom time completely reduced nutritional leaf roll of potatoes grown on light, strongly acid soil. (Amer. Potato Jour. 31: 83).

Yellow spot virus in potato varieties (mostly Katahdin) in Aroostook County, Maine was reported by Bonde and Merriam. Experiments have shown that the virus can be eliminated by planting tuber unit seed plots and by careful selection and propagation of healthy tuber units. (Phytopath. 44: 608).

SPINACH: OLERACEA. SPINASH: W. L. Smith, Jr. reported the effectiveness of streptomycin in reducing post-harvest bacterial soft rot of spinach leaves packaged in plastic bags. (Phytopath. 45: 88).

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION



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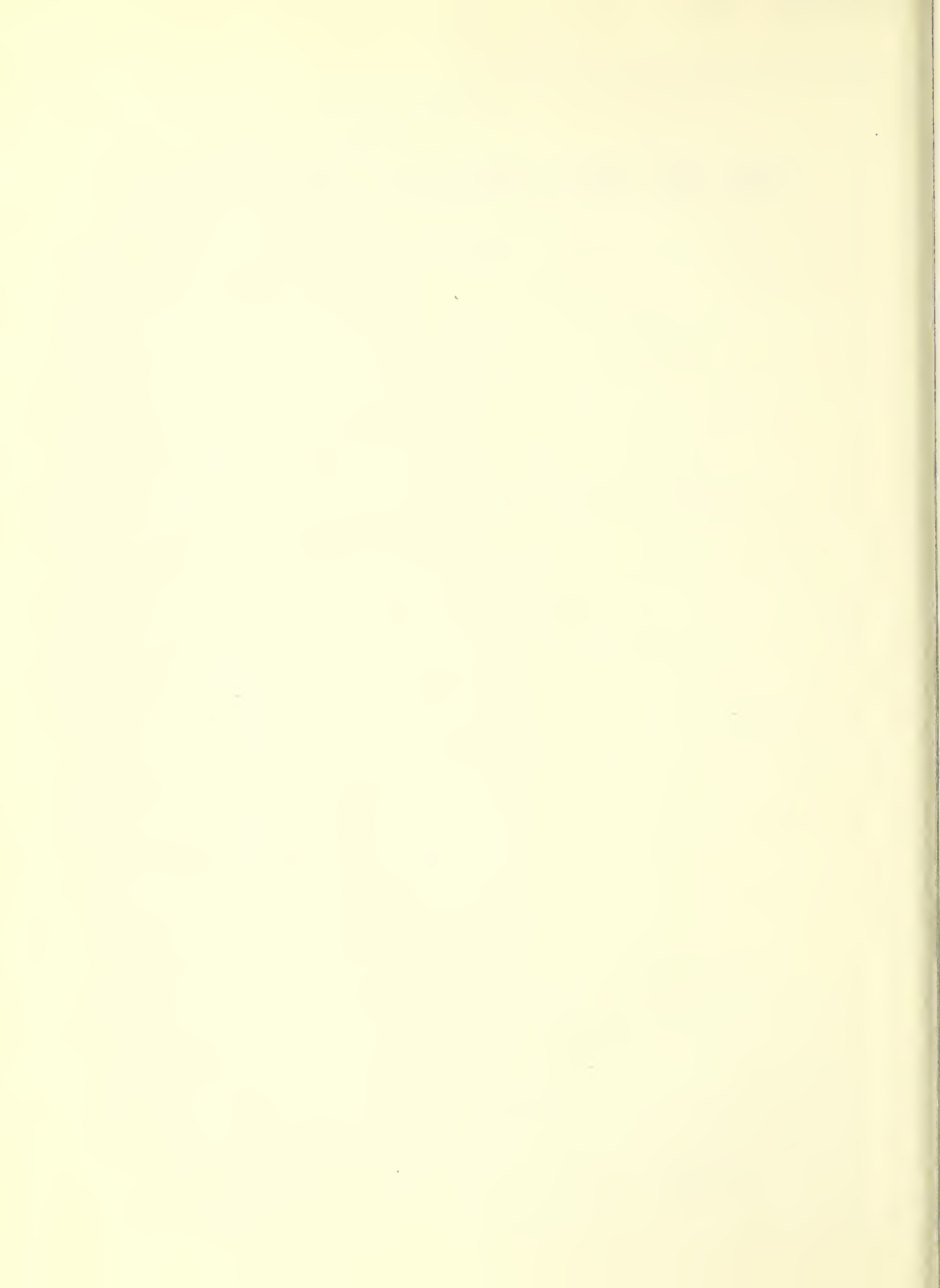
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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Plant Disease Epidemics and Identification Section serves merely as an informational clearing house. It does not assume responsibility for the subject matter.



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Compiled by Nellie W. Nance

Horticultural Crops Research Branch
Supplement 236

Plant Industry Station, Beltsville, Maryland
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- Supplement 231. Tomato late blight: Its world distribution and present status. pp. 1-91. April 30, 1955. By Paul R. Miller and Muriel J. O'Brien. This includes a table of contents and general index.
- Supplement 232. Check list of the diseases of grasses and cereals in Alaska. pp. 93-102. May 30, 1955. By Roderick Sprague. Host Index.
- Supplement 233. Fifth revision of the international register of physiologic races of Puccinia rubigo-vera (DC.) Wint. f. sp. tritici (Eriks.) Carleton = (Puccinia triticina Erikss.). pp. 103-120. October 15, 1955. By C. O. Johnston and M. N. Levine. This includes an analytical key for the identification of physiologic races of P. rubigo-vera determined on the basis of their parasitic behavior on differential varieties of Triticum vulgare.
- Supplement 234. Systemic chemicals. pp. 121-134. November 15, 1955. Papers presented at the Wooster meeting, North Central Division, American Phytopathological Society, Wooster, Ohio. See its table of contents and the author index below.
- Supplement 235. Some new and important plant disease occurrences and developments in the United States in 1954. pp. 135-175. December 15, 1955. Compiled by Nellie W. Nance.

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ERRATA

On page 128, next to last paragraph, read (*Xanthomonas phaseoli*) instead of (*Xanthomonas phaesoli*).

On page 144, read *AGROPYRON CRISTATUM* instead of *AGROPYTON CRISTATUM*

On page 161, next to the last paragraph, read *Scindapsus aureus* instead of *Scindapus aureus*. Also read *Gerbera jamesonii* instead of *Gerba jamesonii*.

On page 168, read *PARTHENIUM ARGENTATUM*. *GUAYULE*: instead of *PARTHENIUM ARGENTATUM*. *GUYULE*:

On page 168, under *SACCHARUM OFFICINARUM*. read *Fusarium moniliforme*, instead of *Fusarium moniliforne*.

On page 175, read *SPINACIA OLERACEA*. *SPINACH*: instead of *SPINACH: OLERACEA*. *SPINASH*:

PLANT DISEASE EPIDEMICS AND IDENTIFICATION SECTION

